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Alternative Transportation Modes
Feasibility Study
Volume II

DENALI

National Park and Preserve • Alaska

Alternative Transportation Modes
Feasibility Study
Volume II

May 1994

DENALI

National Park and Preserve • Alaska

United States Department of the Interior • National Park Service • Denver Service Center
Prepared by BRW, Inc., in association with Dames & Moore

This study has been prepared by BRW, Inc. and Dames and Moore under the direction of the Branch of Transportation, Denver Service Center, National Park Service. The study has been reviewed by the National Park Service and the U.S. Department of Transportation. Appropriate changes have been incorporated based on these reviews. NPS staff have provided assistance, review, and guidance during the course of the study. Special thanks are extended to the staff of Denali National Park and Preserve for their assistance in collecting and assembling data. The staff of ARA Leisure Services are also recognized for their contributions to the study.

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PURPOSE

Section 1050 of the Intermodal Surface Transportation Efficiency Act of 1991, Public Law 102-240, requested that a study be conducted of alternatives for visitor transportation in the national park system. Because of congressional intent and interest, the study used Denali National Park and Preserve, and Yellowstone and Yosemite national parks as case study examples. Each of these park units have special transportation problems.

The major purpose of this study, as stated in the 1991 act, is to evaluate the following:

> 1. The economic and technical feasibility, environmental effects, projected costs and benefits as compared to the costs and benefits of existing transportation systems, and general suitability of transportation modes that would provide efficient and environmentally sound ingress to and egress from national park lands; and
>
> 2. Methods to obtain private capital for the construction of such transportation modes and related infrastructure.

The study included an evaluation of specific alternatives to private vehicle travel in each of the three parks and a comprehensive inventory of transportation technologies that can serve visitor transportation needs within the national park system.

Transportation problems in the national park system are a cause for increasing concern. The issues leading to this study included the following:

- increasing traffic congestion in many park units, indicating a need for alternative transportation modes to enhance resource protection

- potential enhancement of the visitor experience and reduced vehicular congestion with the increased use of visitor transportation systems

- increasing rates of deterioration of park roads from increased traffic and age

- rapidly expanding roadway construction needs

The information presented in this study is intended for use in the conceptual development and evaluation of transportation alternatives in Denali National Park and Preserve. It provides a preliminary assessment of the feasibility of visitor transportation system options in the park. The study is not intended to produce a recommended alternative for visitor transportation. More in-depth engineering and environmental impact analyses of specific conditions will be required to confirm the cost estimates presented here and to conform to the National Environmental Policy Act and other legislative requirements for proposed improvements in units of the national park system.

PREFACE

The results of the *Alternative Transportation Modes Feasibility Study* are presented in four separate volumes. This volume, Volume II, presents the findings of the feasibility study for Denali National Park and Preserve. Volume I provides an overview of transportation planning for national parks and an inventory of alternatives to private vehicle travel within parks. Volumes III and IV present the results of evaluations of alternative transportation systems for Yellowstone and Yosemite national parks, respectively.

Throughout the *Alternative Transportation Modes Feasibility Study*, only those transportation technologies that have been proven in everyday use have been evaluated in detail. Volume I identifies emerging technologies that show the greatest promise for future application in the national park system. As these and other new technologies are developed and proven, a broader range of options may be available for use in park units.

The study has concentrated on transportation within and near Denali.The transportation of visitors to the park from remote locations was not considered directly during this study. However, the National Park Service (NPS) recognizes the value of integrating the planning of transportation systems within the parks with the efforts of surrounding communities to address transportation issues. Visitor transportation systems in the parks must respond to transportation requirements that will vary depending on visitors' means of traveling to parks.

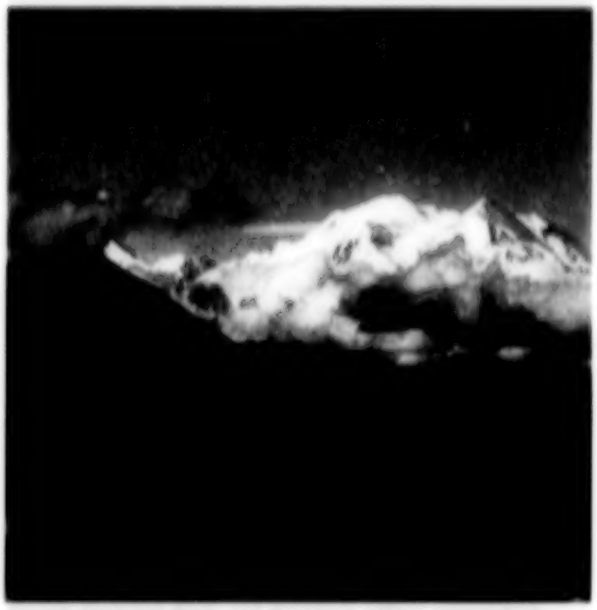
Undoubtedly, many opportunities will be available to enhance the economic development potential of gateway communities and to reduce the impacts of transportation on park resources by providing innovative transportation systems based in the gateway communities. Such systems could be extensions of or complements to internal visitor transportation systems. A cooperative approach to visitor access and internal park transportation could enhance efforts to preserve regional ecosystems while improving the overall quality of visitors' experiences in national parks.

The movement of visitors to and between attractions within parks accounts for the majority of travel within the national park system. Consequently, the resources available for this study have been concentrated on the question of how best to serve the transportation needs of visitors. Frequently, the transportation of NPS and concessioner employees is also an issue, especially at the larger park units. Specific planning efforts in each park unit should explore the opportunity to address both visitor and employee transportation needs with alternative transportation systems. The ability to serve both groups of travelers with a single system will depend on the location of employee housing, an issue which is outside the scope of this study.

Transportation planning for parks is but one element of a complete and systematic planning process that is conducted to determine the future of the nationally significant areas that have been set aside as units of the national park system. As urban planning professionals have recognized that effective land use and transportation decisions cannot be made independently, recreation and park planners, and managers have increasingly embraced the idea of coordinated planning for resource management, visitor facilities, and transportation systems.

Transportation systems in national parks play a crucial role in determining the quality of visitors' experiences in the parks and have a strong influence on resource preservation. In developing transportation alternatives for Denali and other units of the national park system, management and staff should consider how those alternatives can best support the broader purpose and values of the National Park Service and the individual park.

EXECUTIVE SUMMARY



Denali National Park and Preserve offers unmatched scenery in a wilderness setting.

Denali National Park and Preserve, in south central Alaska (see map on the following page), is unique among units of the national park system. The park affords visitors an opportunity to experience vast areas of unspoiled wilderness on a personal basis, along with the unmatched scenery and diverse and abundant wildlife, all in conditions that are as free from man's influence as is possible while still providing for visitor access.

Denali contains resources of international significance - the highest mountain on the North American continent and a very large, continuously protected ecosystem. For this reason, it has gained international recognition through its designation as a biosphere reserve under the Man and the Biosphere program of the United Nations. Denali is a popular destination, known for it views of Mount McKinley and for its wildlife viewing within a wilderness environment. It is the only place in the national park system where visitors can expect to consistently see caribou, Dall sheep, moose, and grizzly bears - the big four of Alaskan wildlife -in a single day of travel.

Because of frequent cloud cover, Mt. McKinley is not visible on many days during the summer. As a result, wildlife viewing is the primary source of enjoyment for many visitors.

A delicate balance between accessibility, preservation of park resources, and provision for visitor enjoyment and resource interpretation is maintained at Denali through the restriction of private vehicular traffic and the provision of a carefully managed array of visitor transportation systems (VTS). Most visitors to Denali are making a once-in-a-lifetime trip to Alaska. The sense of adventure for visitors to the park is heightened by the character of the park road, the flow of events during the seven- to 11-hour shuttle and tour trips, and the immense scale of the landscape, which seems to swallow up the road and the small buses that operate along it.

Wildlife viewing is the primary source of enjoyment for many visitors.

VISITOR USE AT DENALI

Although Denali National Park and Preserve covers over 6 million acres, most visitor use occurs within a limited area. Aside from air service to the lower slopes of Mt. McKinley for climbers, the Denali park road provides the only visitor access to the park's interior. For the majority of its 92-mile length, the road is unpaved. The road crosses rugged mountain terrain, and has several sections with steep grades, sharp curves, and narrow widths, making the road inappropriate for unrestricted use by private vehicles. The road lies within a 300-foot right-of-way that is surrounded by designated wilderness lands. The park road corridor is illustrated on the map on the following page.

Since 1972, only a few overnight campers and a limited number of professional photographers, scientists, and others with special permits have been allowed to use private vehicles on the park road beyond a check station at Savage River, 15 miles from the park entrance. More than 95% of the visitors travelling into Denali's interior use shuttle buses provided by the Park Service or ARA Leisure Services, the major concessioner at the park.

Visitation to the interior of Denali National Park and Preserve has increased dramatically since the completion of the George Parks Highway in 1972, which provides direct paved highway access from both Fairbanks and Anchorage. Annual ridership on buses travelling into the park reached 217,975 in 1992, approximately double the 1980 level, as shown in figure ES-1. At the current rate of growth, the demand for visitation to Denali will double in seven to eight years.

The majority of visitors to Denali can be categorized into two distinct groups - visitors arriving in package tour groups and visitors arriving as individual parties. A few other visitors stay at four lodges in the Kantishna area, a cluster of private inholdings located at the end of the park road. The use patterns, length of stay, and type of experience encountered by each of the two major visitor groups are described below.

Package Tour Visitors

About half of all visitors to the park are participants in package tours. The greatest number of these visitors travel to the park via the Alaska Railroad as part of a larger Alaska tour. Package tours are the fastest growing component of visitation to Denali.

The itineraries of package tour visitors are closely managed to allow the Denali visit to fit into the overall tour program. The typical schedule for these visitors involves an overnight stay at the Denali Park Hotel or at one of the lodges just outside the park along the George Parks Highway. Package tour visitors are assigned to prescheduled tours of the park interior aboard buses operated by ARA Leisure Services.

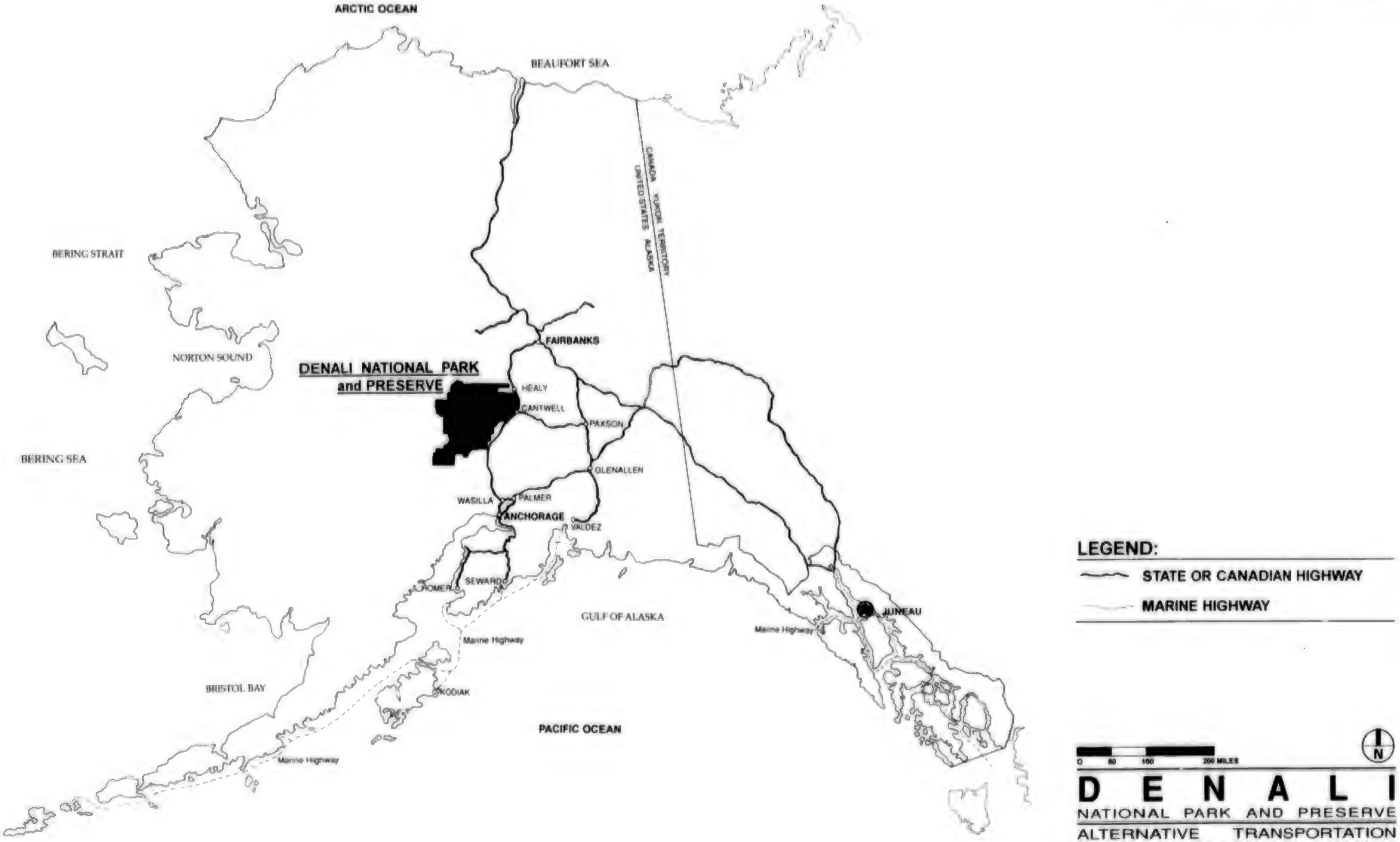
ARA provides the Denali wilderness tours and Denali natural history tours into the park interior using a dedicated fleet of Bluebird buses. These buses accommodate 52 passengers and are based on a typical school bus design with modified seating.

The Denali wilderness tour travels to Stony Hill Overlook at mile 62 of the park road, where a dramatic view of Mt. McKinley is available on clear days. Tour passengers are provided a box lunch as part of the $45.00 adult fare. Tour buses make unscheduled stops along the road as scenic and wildlife viewing opportunities arise.

The Denali natural history tour operates between the Denali Park Hotel and Primrose Ridge, a distance of about 16 miles, one way. This shorter tour provides access to the park for visitors with less time to spend or a desire for a less lengthy ride into the park interior; it helps reduce bus volumes and congestion on the more distant sections of the park road. The adult fare for the natural history tour was $25.00 in 1992.

The drivers on both tours provide extensive narration covering the history, wildlife and geology of the park. Visitors stay with their assigned buses, leaving the vehicles only at scheduled rest stops along the route. Although most package tour visitors now use the wilderness tour, ridership on the natural history tour is expected to increase while use of the wilderness tour remains stable.

VICINITY MAP

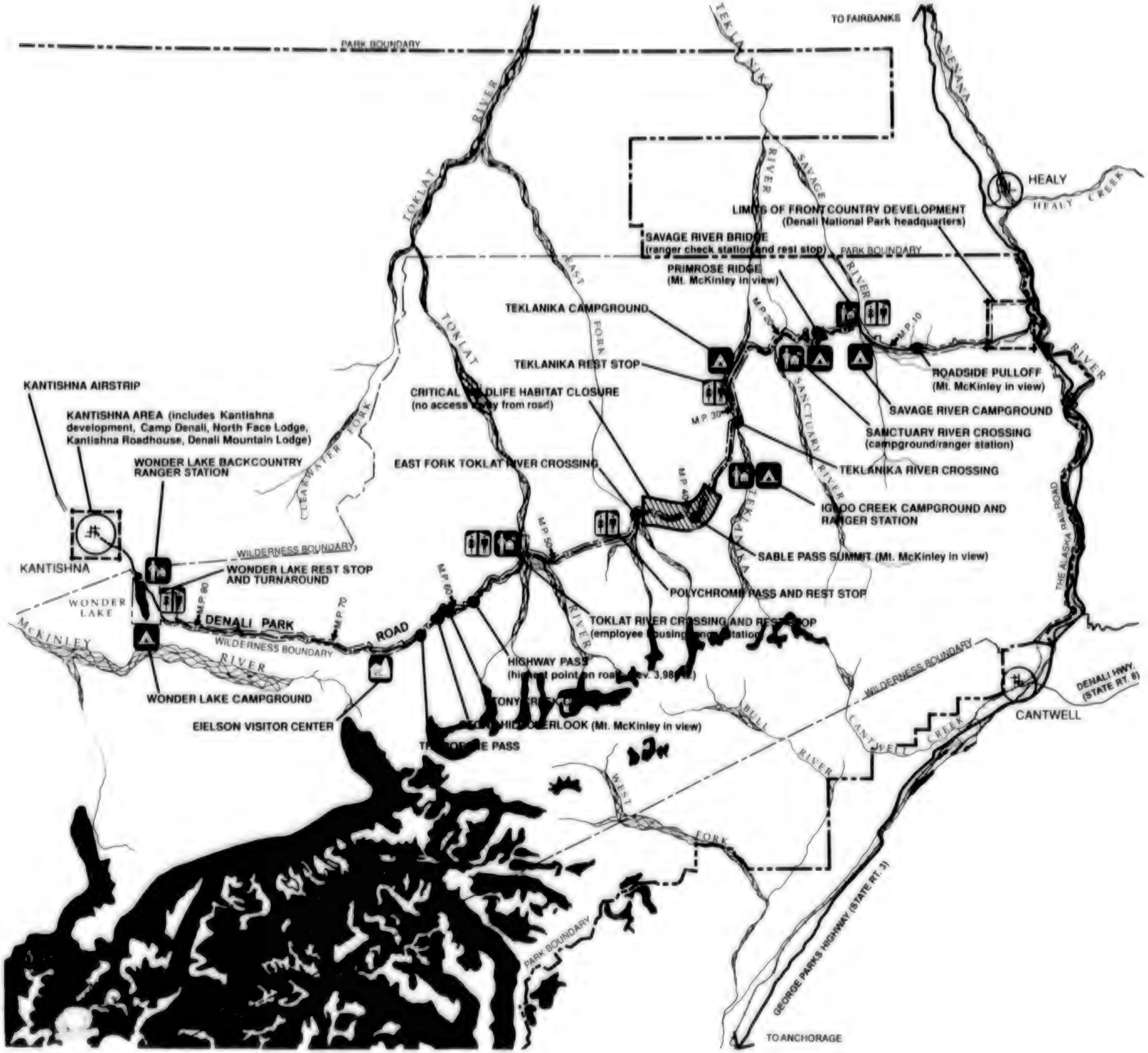


D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC/APRIL 94/184 20058A



DENALI ROAD CORRIDOR

LEGEND:

🚻	REST STOP
VC	VISITOR CENTER
▲	CAMPGROUND
	RANGER STATION
●	POINT OF INTEREST
⬚	AREA OF DEVELOPMENT
←M.P.	MILEPOST MARKER

0 1 5 10 MILES

N

D E N A L I

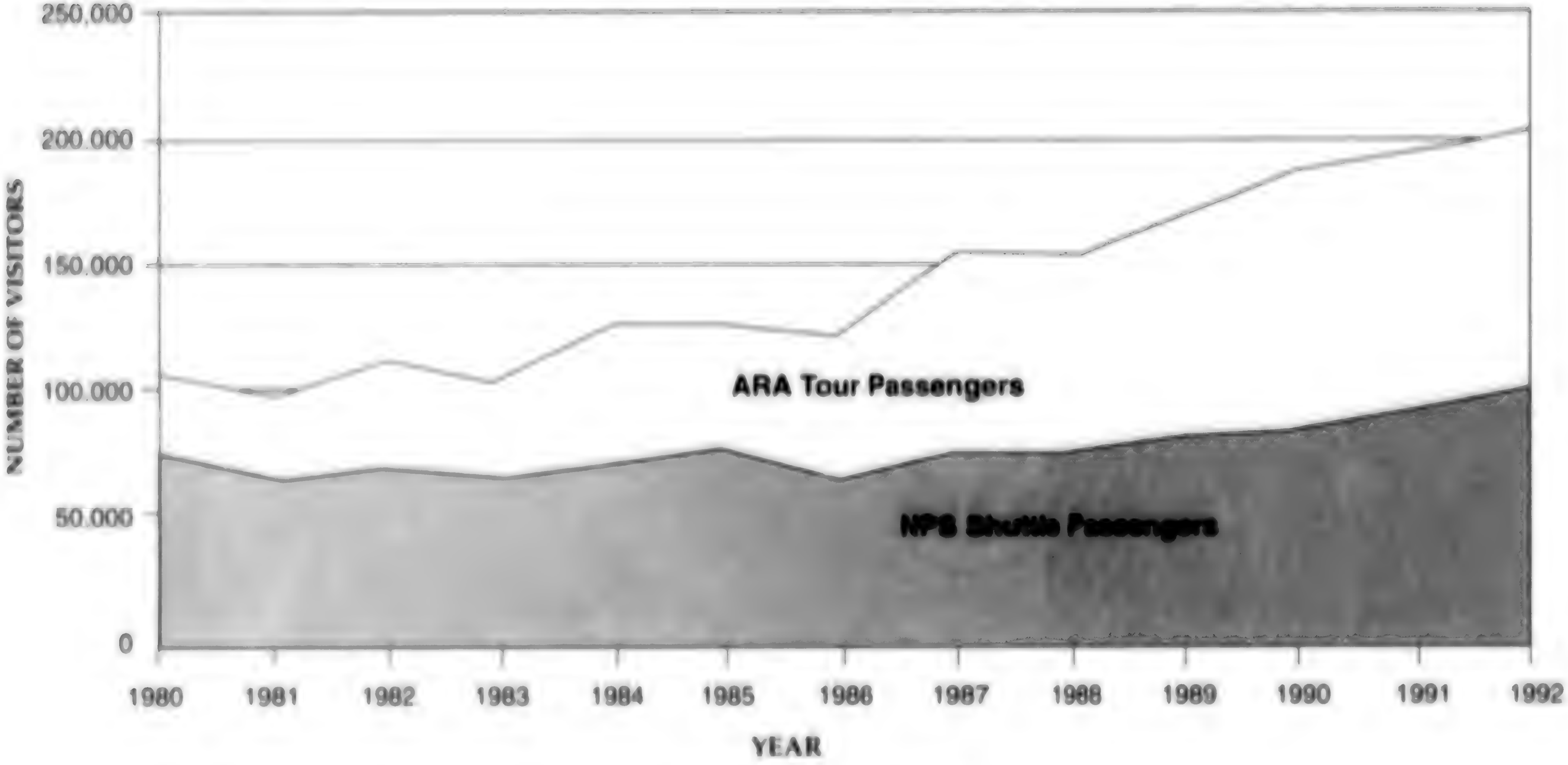
NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC/APRIL 94 | 184 20059B

Figure ES-1: Denali National Park and Preserve

Annual Shuttle and Tour Ridership Passing Primrose Ridge



SOURCE: Visitor statistic compilations prepared by the Denali staff, Denali staff data base, ARA staff

NOTE: Does not include ARA natural history tour

School buses provide shuttle service along the park road.

Visitors in Individual Parties

Visitors who travel to Denali in individual parties typically arrive in private vehicles, including a large proportion of recreational vehicles. This group of visitors have a more diverse range of experiences available as part of their visit to the park than the package tour visitors. Most of the individual visitor groups stay overnight at campgrounds in the park, at formal camping areas outside the park boundaries, and at informal roadside pullouts along the George Parks Highway.

Individual visitor parties are provided with less organizational assistance in planning and carrying out their visit than the package tour visitors. The only means of access to the park interior for all but a few of these visitors is a system of shuttle buses operated by a private carrier under contract to the Park Service. The shuttle buses are available free of charge to visitors who pay the $3.00 per vehicle park entry fee. Reservations for most seats on the NPS shuttles must be made in-person at the park's visitor access center (VAC). Some seats may be reserved through outlets in Anchorage and Fairbanks.

Shuttle service is provided between the visitor access center and Wonder Lake, 86 miles into the park. The round-trip travel time to Wonder Lake is 11 hours. Most of the shuttle bus trips turn back toward the park entrance at Eielson Visitor Center at mile 66, with six trips per day continuing to Wonder Lake.

Demand for the shuttles is high, and visitors typically wait one to two days for a reserved seat. This waiting period increases the demand for overnight accommodations in and near the park. Many visitors arriving at the park are not informed about the reservation process and may not have planned for the necessary wait in their travel schedules.

Visitors may wait one to two days for a shuttle ride into Denali.

The shuttle service employs idle school buses used to transport Alaska public school students during the winter. The spacing between rows of seats is widened to allow adults to sit more comfortably. During the 1992 season, 44-seat buses were used in the shuttle system.

The system of shuttle buses includes special trips for use by overnight visitors to the campgrounds and backcountry areas served by the park road. Seats are removed on the buses used for camper transportation to make room for gear.

Riders on the NPS shuttle buses are encouraged to get off and hike through the wilderness areas surrounding the road corridor. Empty seats are provided to allow visitors to use other buses to continue their trips or return to the visitor access center. Buses will stop on request for passenger boarding or exiting, except within close range of wildlife sightings. Although the NPS drivers are not required to provide narration during the trip, many make informal interpretive presentations. Visitors must bring their own food and beverages along on the shuttle trip.

TRANSPORTATION ISSUES IN DENALI

Since the completion of the *General Management Plan* (GMP) for Denali in 1986, private vehicular traffic has been reduced by requiring the users of all campgrounds in the park interior except Teklanika to ride the NPS shuttle system to their campsites. The increase in visitation to the park since 1984 has been accommodated by expanded use of the ARA tours and NPS shuttles.

The combined volume of bus trips into the park interior increased by more than 40% between 1984 and 1988. Since 1989, bus traffic on the park road beyond Primrose Ridge has remained fairly constant, with the natural history tour accounting for the majority of new bus trips.

Denali Park Road Traffic

Although careful management of transportation resources has allowed visitation to increase while maintaining the essential wilderness character of Denali, the transportation system is showing signs of stress. Figure ES-2 shows traffic volumes passing Savage River and those going beyond Primrose Ridge in 1992.

The traffic bound for Kantishna, shown in figure ES-2, is composed of private vehicle trips, bus trips operated by the Kantishna lodges, and maintenance-related traffic. The Alaska National Interest Land Conservation Act requires the Park Service to provide *adequate and feasible access* to private inholdings at the end of the park road in Kantishna. A major expansion of visitor-related facilities in Kantishna could result in increased private vehicle traffic along the road, raising concerns for both safety and congestion.

The current daily volume of NPS shuttle and ARA tour bus trips along the park road provides an appropriate balance among the goals of providing for visitor access, protecting park resources, and offering a high-quality visitor experience in keeping with the special nature of Denali National Park and Preserve. Increasing bus travel and expanding use of the park road by other vehicles are not acceptable means of serving increasing visitation demand at Denali.

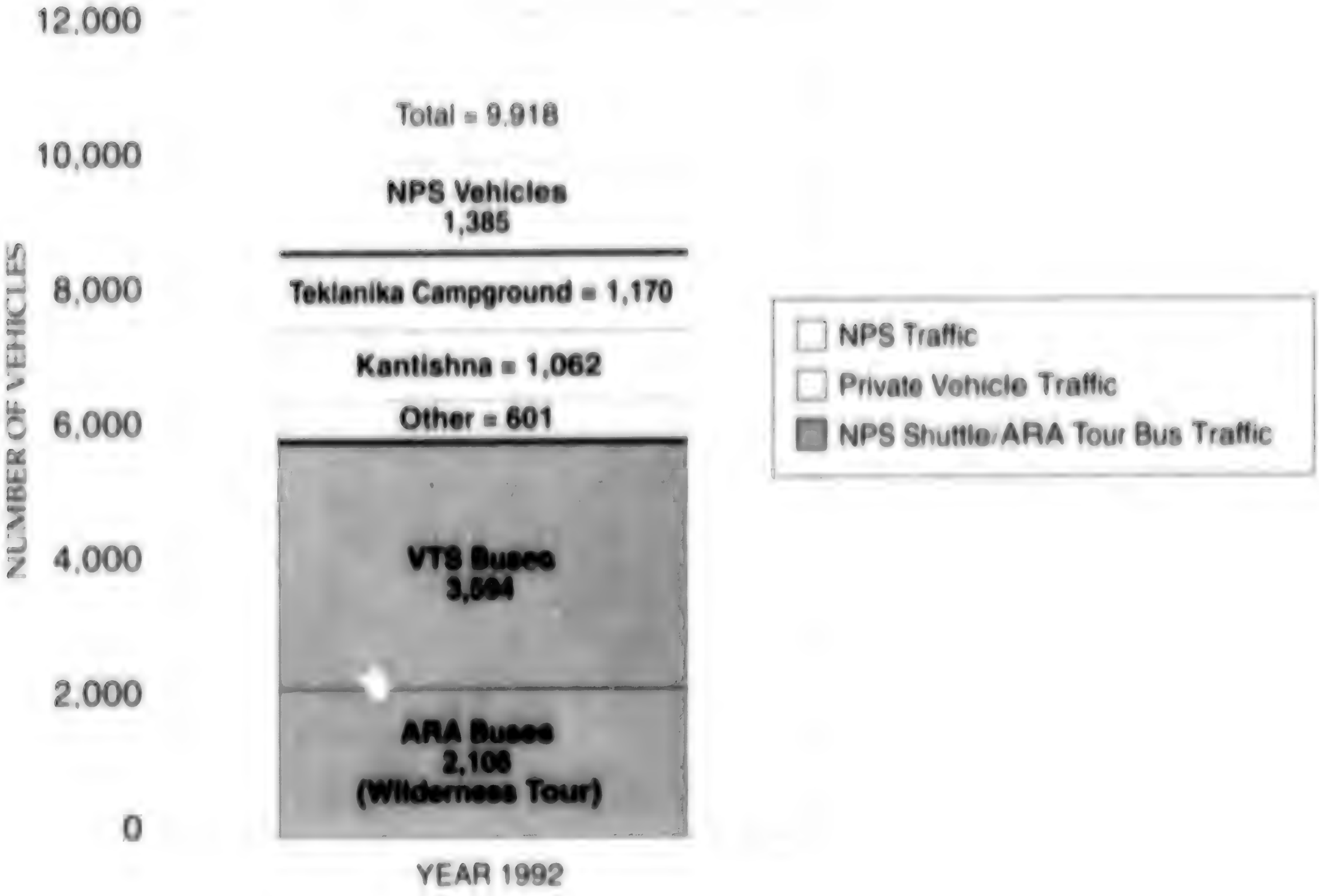
With the existing number and frequency of bus trips, it is not uncommon for several buses travelling in each direction to be stopped near a wildlife sighting. The time between vehicles passing a given point on the road is short, affording only brief interludes of serenity for those enjoying the wilderness areas near the road corridor and for animals crossing the road during migratory periods. Any increase in bus travel will significantly exacerbate the disruption to wildlife and visitor enjoyment associated with traffic on the park road. Increased traffic would also expose visitors to a greater risk of accidents, because vehicles would need to pass one another on steep and narrow sections of the road more frequently.

Denali Visitor Transportation Systems

The current system of buses used by ARA and the NPS contractor is functional and cost-effective; however, to at least some of the passengers, the NPS school buses are perceived as uncomfortable. The concessioner's Bluebird buses and the NPS school buses have small windows compared to other types of buses, limiting visibility for some passengers. Dust along the road is causing localized impacts to vegetation and can periodically obscure close-range views and intrude on park vistas.

Figure ES-2: Denali National Park and Preserve

Traffic Passing Savage River



SOURCE: Savage River station count, Denali staff. *General Management Plan*

Despite these inconveniences, the existing system of transporting visitors in and around Denali has served the park well since its establishment in 1972. However, growth in visitation has strained the system's ability to provide a quality experience to visitors. Figure ES-3 shows 1992 season ridership and capacity for Denali's VTS services.

The ARA wilderness tour is at 99% of capacity. This portion of the concessioner's operation can accommodate only a small amount of additional growth through conversion of the fleet to larger buses. The ARA Natural History Tour provides some opportunity to address future visitor needs by providing a more limited but still valuable experience. The occupancy of the natural history tour system as currently operated is 70%. Additional buses could be operated with minimal impact to the environment and wildlife of the park.

In 1992 the NPS shuttle system carried about 85% of the passengers who could have been served under ideal operating conditions. As a result of the one- to two-day wait for access to the shuttle system, up to one in five visitors wishing to use the NPS buses are unable to make a reservation or are no-shows for their scheduled trip. Although it would be possible to modify the current operation to increase the number of visitors travelling into the park, without investment in a reservation system, only a small increase in visitation could be accommodated on the shuttle system. Any growth in use without a change in reservation practices would probably result in further lengthening of the already inconvenient wait for access to the park interior.

An improved reservation system, refinements to VTS operations, and upgrades to the bus fleet could provide enough additional capacity to accommodate two to three years of visitation increases, assuming historic visitation trends continue. The Park Service is committed to implementing a reservation system for the shuttle service.

VISITOR AND RESOURCE ISSUES

Increased visitation to Denali has resulted in crowding at facilities providing visitor services throughout the park. Visitors in individual parties obtain reservations for shuttle bus trips and for camping at the visitor access center (VAC). This facility is also the boarding point for shuttle trips into the park interior. The center is always crowded during the summer months of peak visitation. As shown in figure ES-4, the VAC parking lot fills by noon.

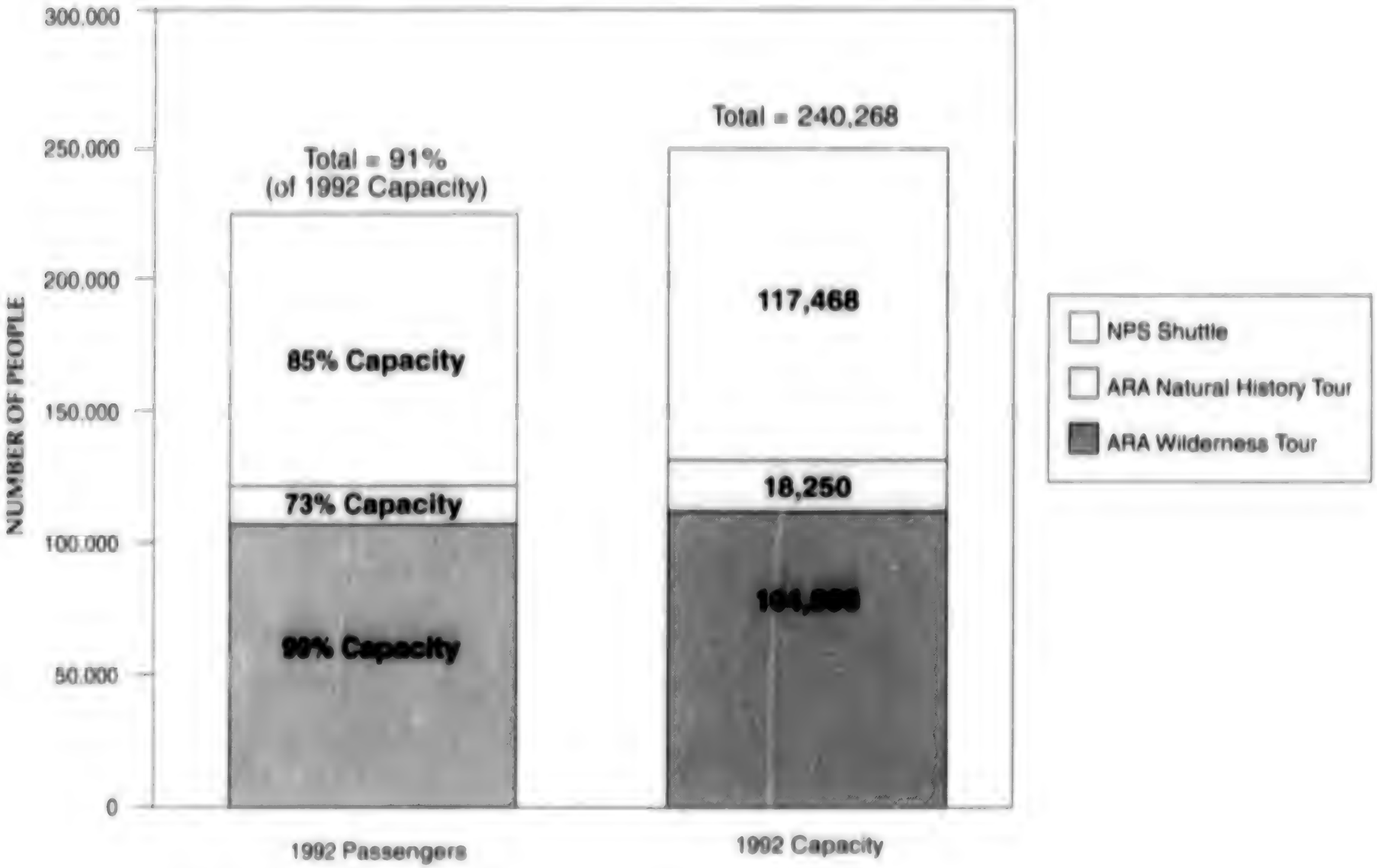
The waiting period for access to the NPS shuttle buses is inconvenient for some visitors and causes the demand for overnight accommodations in the area to exceed the supply. The demand for overnight accommodations could be reduced by as much as 500 units if the waiting period could be reduced or eliminated.

Rest stops along the park road provide a mixture of primitive and modern facilities that can become overtaxed when several buses arrive at one time. The destination for most shuttle bus riders is the Eielson Visitor Center, 66 miles into the park. When weather conditions are poor, Eielson can become overcrowded - no other protection is available for visitors who wish to leave the buses to eat lunch or stretch their legs.

Denali offers pristine conditions, with little evidence of man's presence. A few impacts of the current transportation system and visitor facilities are cause for concern, however. Among the most important concerns are dust and erosion impacts to the road edge along portions of the park road corridor, impacts to Dall sheep migration across the road and caribou movements along the corridor, and soil compaction from social trails being formed at locations with high levels of visitor activity. Expanded use of the Stampede Road corridor, north of the Denali Park Road, could raise Native American concerns due to historical use of the area by native peoples.

Figure ES-3: Denali National Park and Preserve

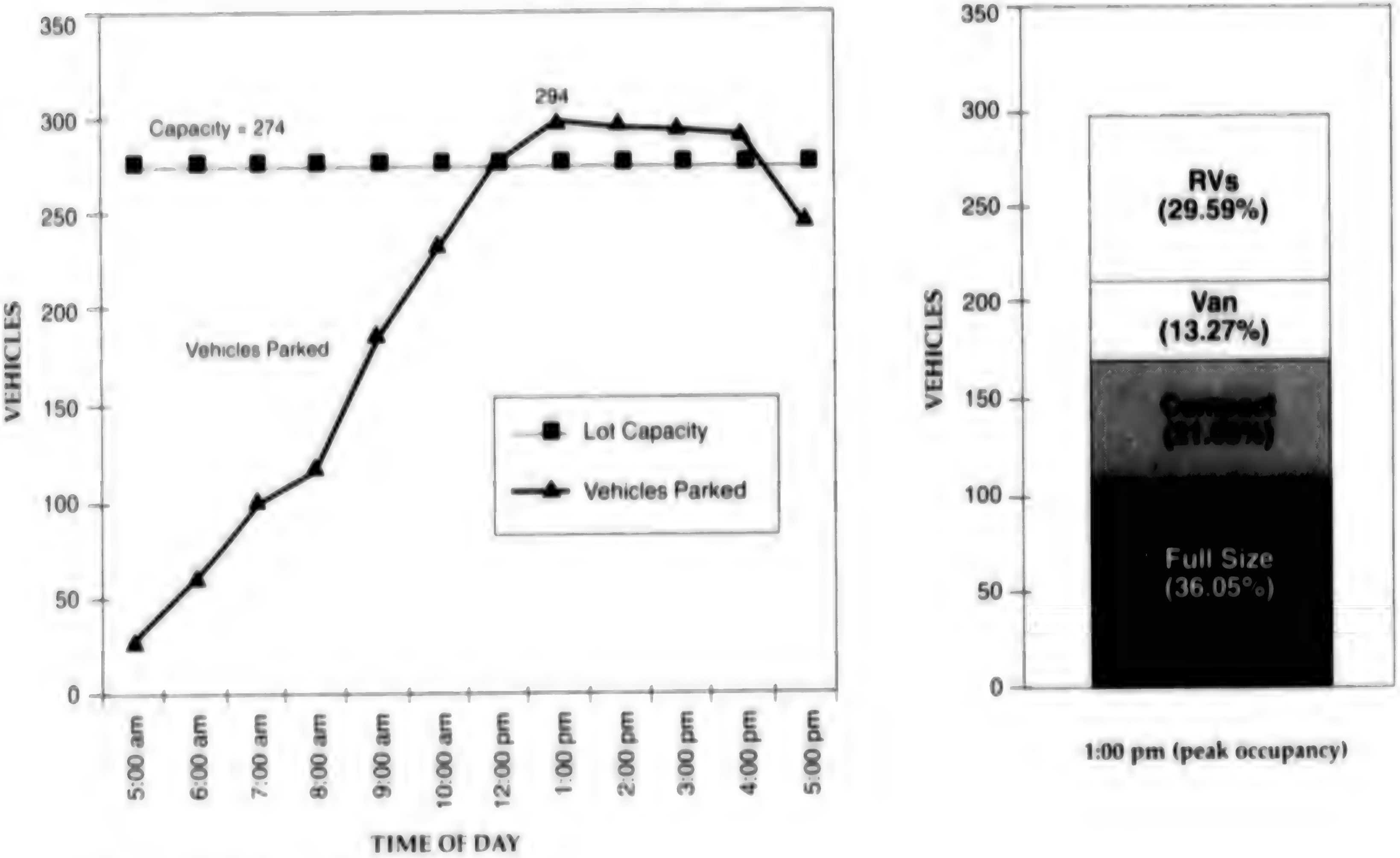
Shuttle/Tour Bus Capacity and Usage



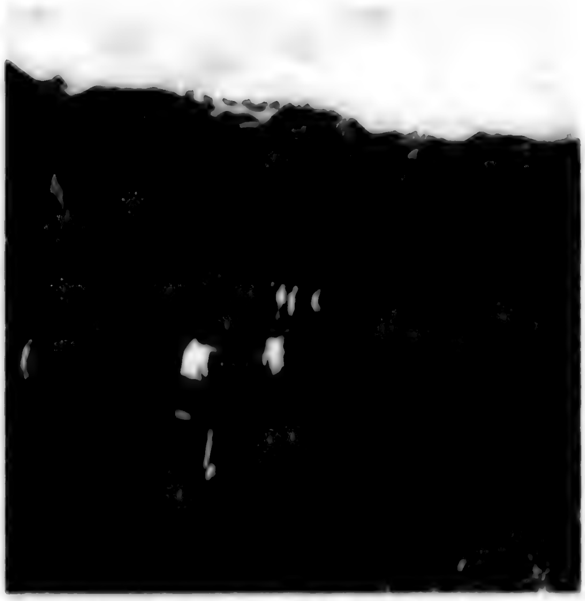
SOURCE: Denali staff data base, ARA staff

Figure ES-4: Denali National Park and Preserve

Parking Occupancy at Visitor Access Center



SOURCE: July 31, 1992 field survey (BRW, Inc.)



Heavy visitor use can damage fragile habitat.

VISITOR TRANSPORTATION SYSTEM ALTERNATIVES

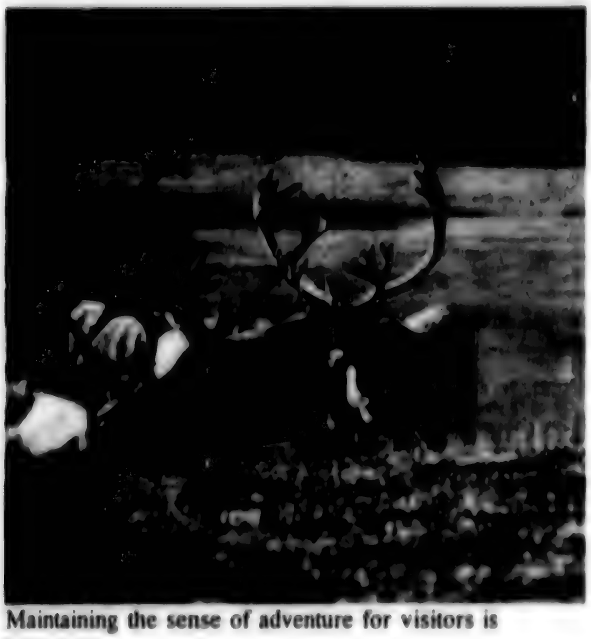
Key Requirements

Long-range options to increase visitor access to Denali were developed in response to the recent increase in visitation and the expectation that visitation demand will continue to grow. The following essential requirements were identified for VTS improvements:

- Result in no net increase in peak season daily transit vehicle "events" along the park road. A vehicle event is defined as the passage of a single vehicle or train in one direction. The current daily number of events totals 208, or double the number of vehicles entering the park interior at Primrose Ridge.
- Allow unrestricted opportunities for wildlife viewing stops on an unscheduled basis.
- Maintain the opportunity for unobstructed views of wildlife at close range.
- Provide service at least to Eielson Visitor Center for day use visitors and access to all campgrounds and backcountry units served by the existing system.
- Accommodate administrative functions, including employee travel and maintenance activities.
- Maintain reasonable access to Kantishna inholdings.
- Be reasonably likely to be constructable within the 300-foot wide wilderness exclusion corridor along the road.

Stopping for scenic and wildlife viewing opportunities is critical.

- Employ proven, available technologies for the movement of passengers and be feasible considering power requirements, material availability, and other factors.
- Be capable of operating in a safe manner in the Denali environment.
- Allow passenger boarding at any point along the route.
- Conform to the requirements of the Americans with Disabilities Act.
- Allow unrestricted wildlife movement across the system.
- Include any required expansion of support and visitor facilities.



Maintaining the sense of adventure for visitors is important.

Initial Alternatives

VTS alternatives considered for development over the long-term included the following four basic strategies:

- Use higher capacity buses to provide service along current routes. Articulated buses and double-decker buses were considered.

- Replace the bus system with a fixed-guideway transit system. Fixed guideway transit technologies considered included light rail transit (LRT); group rapid transit (GRT), including monorail; and diesel-powered cog railway technology.

- Supplement the park road with an alternate route to Kantishna. This strategy was included in the study in response to strong interest on the part of the state of Alaska and private groups. A new road that would be open to private vehicles as well as VTS traffic was assessed, along with a conventional railroad. Both options followed the Stampede Road corridor.

- Develop visitor access via a tramway on the south slope. As an example of tramway opportunities, tramway routes providing access to views of Ruth Glacier, the surrounding mountains, and Mt. McKinley were developed. Two tramway base options - at the base of Alder Point within the park and adjacent to the George Parks Highway within Denali State Park - were identified. Two terminal options were also identified - at Alder Point and at an overlook of the Great Gorge to the northwest of Alder Point (see following map).

Double-decker buses could enhance viewing opportunities and provide more capacity.

A set of criteria were developed to focus the initial screening of alternatives to a small set of feasible options and to direct the comparison of the feasible alternatives for Denali. The criteria were developed to respond to the study purpose as stated in the Intermodal Surface Transportation Efficiency Act and to account for the unique transportation problems and environmental conditions at Denali. The criteria were organized into the following categories:

- visitor transportation and management
- visitor experience
- resource impacts
- consistency with planning goals

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An articulated bus can provide more seats than a conventional bus.

- cost and cost-effectiveness
- implementation

Alternatives Screening

Each of the initial alternatives was subjected to a screening analysis to identify the best opportunities and major obstacles to successful implementation. The following alternatives were found to be inferior to the other alternatives under consideration:

Light Rail Transit. LRT vehicles cannot operate on sustained grades of over 8.0%. The park road has several steep sections, notably Sable Pass and Polychrome Pass, which would require light rail transit to leave the road corridor to maintain an acceptable grade. As a result, light rail transit would encroach onto wilderness lands. Tight curves in these and other sections of the road would also present a problem for this technology. Light rail transit employs overhead wires to supply electric power to the vehicles. The overhead lines would be visually intrusive and the electrification system would require a new 7- to 15-mile power line to be constructed between the LRT line and available power sources, resulting in visual disruption and habitat damage in and outside of the park. An LRT system would be more expensive than the cog railway alternative and the potential wilderness encroachment and visual impacts of light rail transit would offset the noise and emissions advantages offered by electric power.

A light rail transit system would require a substantial electrical power source.

Group Rapid Transit. GRT systems use elevated guideways that require stations for access and egress. A GRT system would not allow visitors to exit the transportation system at any desired location as is now the case. Visitor use would be further concentrated in a few areas, resulting in intensified habitat damage.

Most GRT technologies have grade and curvature restrictions similar to those for light rail transit. Monorail can negotiate somewhat steeper grades, but cannot accommodate curves as sharp as light rail transit. As a result, this class of transit technologies would also encroach onto wilderness lands. GRT technologies employ electric power systems that are incorporated into the guideway.

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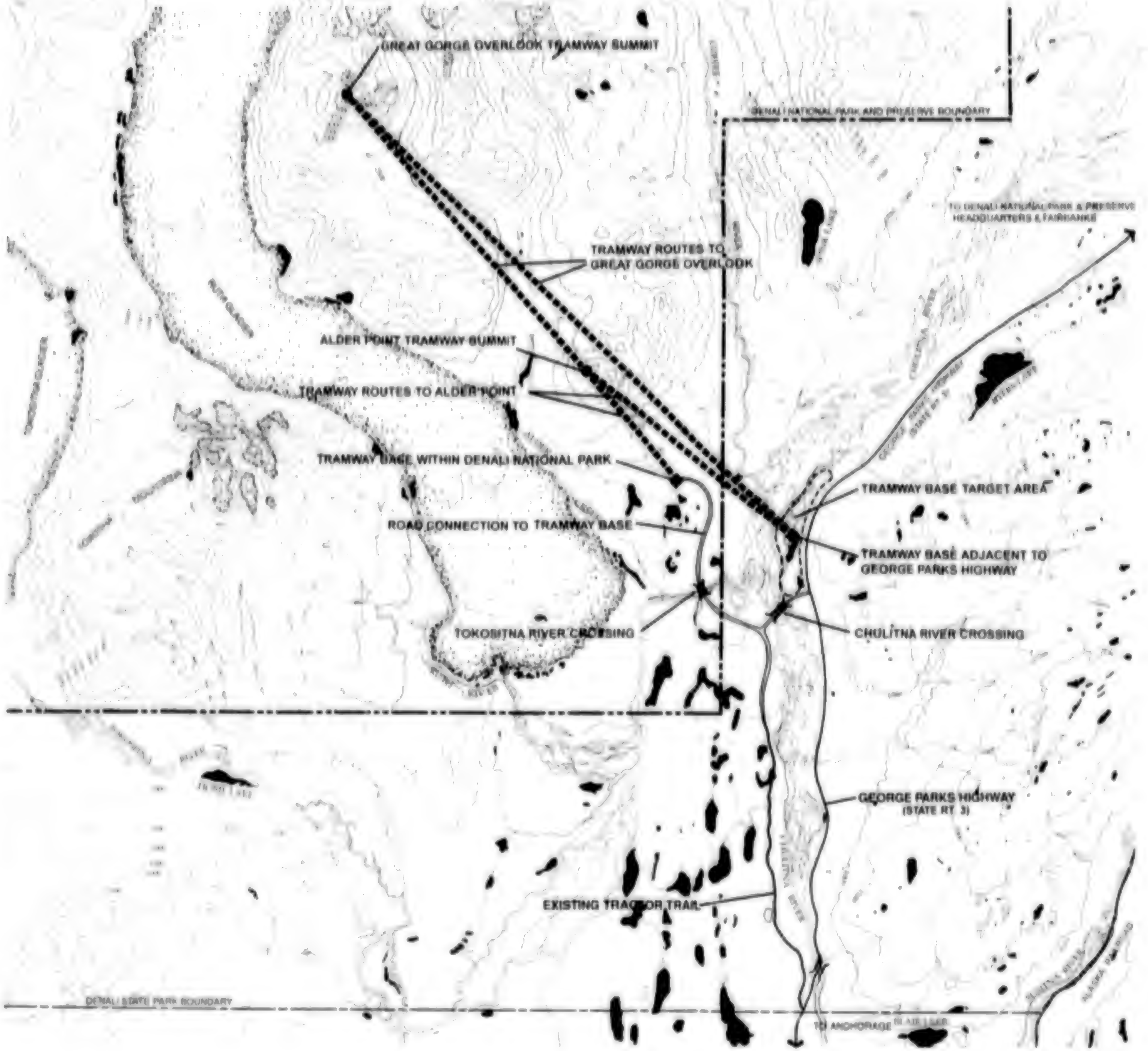
SOUTH SLOPE AERIAL TRAMWAY INITIAL ALTERNATIVES


GREAT GORGE OVERLOOK TRAMWAY SUMMIT
DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE HEADQUARTERS & FAIRBANKS
TRAMWAY ROUTES TO GREAT GORGE OVERLOOK
ALDER POINT TRAMWAY SUMMIT
TRAMWAY ROUTES TO ALDER POINT
TRAMWAY BASE WITHIN DENALI NATIONAL PARK
TRAMWAY BASE TARGET AREA
ROAD CONNECTION TO TRAMWAY BASE
TRAMWAY BASE ADJACENT TO GEORGE PARKS HIGHWAY
TOKOSITNA RIVER CROSSING
CHULITNA RIVER CROSSING
GEORGE PARKS HIGHWAY (STATE RT. 3)
EXISTING TRACTOR TRAIL
DENALI STATE PARK BOUNDARY
TO ANCHORAGE
0
1
2
4 MILES
N

D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

A monorail system was assessed for use in Denali.

The impacts of supplying electrical power to a GRT system would be similar to those for light rail transit. Along the guideway, a GRT electrification system would be less visually disruptive than that for light rail transit but the guideway itself would represent a major visual element that would be incompatible with the surrounding wilderness. An additional problem for group rapid transit is its very high cost. The typical cost range for GRT systems is double that for LRT systems, resulting in an expected cost of over $1 billion for a system along the park road.

Stampede Railroad Route. A rail line or roadway to Kantishna along the Stampede Road alignment would have substantial environmental impacts. The railroad option would be approximately $45 million more costly to construct than the road and would have annual operating and maintenance costs of $1.5 to $2.0 million. The railroad option would not provide any potential advantages for VTS travelers on the park road, while a road could be used as a return route for Wonder Lake VTS trips, reducing traffic on the park road. The road option was carried forward for detailed assessment in combination with the VTS alternatives on the park road. The railroad option along the Stampede corridor was eliminated.

Alder Point Tramway Base and Great Gorge Overlook Tramway Terminal. The base of Alder Point was eliminated as a potential tramway base due to the difficulty of providing roadway access and the concentration of grizzly bear use in the area. Because of its distance from the tramway base, the Great Gorge overlook point would require four separate tram segments with three transfers. The excessive number of terminal facilities and associated costs and the inconvenience associated with the transfers caused the Great Gorge terminal option to be eliminated.

An aerial tramway could carry visitors to Alder Point for an overlook of Ruth Glacier.

Final Denali VTS Alternatives

The screening process for the long-range options for VTS improvement yielded the following set of final alternatives.

Bus Alternatives. The bus alternatives would provide passenger service to Eielson Visitor Center and Wonder Lake along the existing park road. An integrated concessioner and NPS operation was assumed. Both 52-passenger and 72-passenger buses were evaluated. Passenger capacity was determined based on current

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volumes of NPS and ARA bus trips along the corridor. The impact of adding access to Kantishna along the Stampede Road also was evaluated.

It was assumed that private traffic to the Kantishna area would use the Stampede route, if it was available. In addition, the number of VTS trips to Wonder Lake was allowed to double for the bus alternatives with Stampede Road, assuming that the Wonder Lake bus trips would return to the staging area via Stampede Road.

The study identified a range of potential dust abatement treatments that could be tested on the park road. These treatments may be appropriate for immediate use and should be considered for use with the long range alternatives which rely on bus technology. Appendix 5 identifies the treatment options and a preliminary assessment of the advantages and disadvantages of each.

Cog Railway Alternative. A two-track railway, built on the park road alignment and using a combination of cog technology on steep sections and standard adhesion technology along the remainder of the route, was analyzed. Self-propelled, diesel-powered units similar to those operating on Pikes Peak in Colorado were assumed.

The cog railway technology offers the potential to design the visitor transportation system to fit into the wilderness environment of Denali with minimal visual impact. Cog railways have a character that could contribute to the mountain ambiance of the park.

Terminal points at both Eielson Visitor Center and at Wonder Lake were considered. The cog railway alternatives included shuttle bus service from the end of the railway line to Kantishna and, in the case of an Eielson railway terminal, to Wonder Lake. For the Eielson terminal option, the impact of constructing the Stampede Road was also analyzed.

The cog rail alternatives could serve the target visitation level of 400,000 per year with fewer than the allocated maximum VTS vehicle events because cog rail vehicles can be coupled together to gain more capacity. In the evaluation of alternatives, these options received credit for a reduction in total vehicle events and a reduction in wildlife impact.

For this comparison of the alternatives, a new staging area near the Savage River campground has been assumed, based on suggestions by the Denali staff. South of the existing campground, the former site of a lodge and an unused airstrip offers a potential staging area site that would take advantage of previously disturbed ground. The cost of the cog railway alternative is reduced significantly by locating the staging area at Savage River, shortening the length of the rail line by some 14 miles compared to a staging area near the visitor activity center. For the bus alternatives, the staging area could be at an expanded visitor activity center or at another location near the park entrance with little impact on capital or operating costs.

Ruth Glacier Tramway. A tramway system with a base along the George Parks Highway within Denali State Park and a terminal at Alder Point was evaluated. The 5.5 mile tramway system would consist of two equal sections. An intermediate transfer station would be located on the slope leading to Alder Point. Alder Point affords views of the Ruth Glacier and the Tokosha Mountains and of Mt. McKinley in clear weather. This tramway option is representative of a number of opportunities to develop visitor access to glacier and mountain viewing areas on the south slope of the Alaska Range.

Park Road Improvement. Improvements could be made to the park road surface to improve its stability and potentially decrease dust. Seasonal freezing and thawing and unstable permafrost soils would lead to high maintenance costs for a paved road. Because pavement is not permeable, surface runoff could cause greater erosion problems at the edge on a paved roadway than on a gravel road. Also, a paved roadway section would cause a wider area of disturbance than the existing gravel road and a much higher construction cost than simpler stabilization measures. As a result, paving the park road was not considered in conjunction with the VTS alternatives for Denali. The simplest type of stabilization would be to blend angular, well graded, crushed aggregate into the top 6 inches of the existing road structure. This would add strength to the road, but provide flexibility for frost action.

A higher degree of stabilization could be achieved by adding a liquid binder to the top 3 inches of the mixed gravel. The fluid would cement the top layer of the road surface and provide water-proofing. Dust would be greatly reduced, as well.

Road stabilization could be undertaken with no change in existing VTS operations and could be combined with the bus alternatives described above. Costs would range from $154,000 per mile for the simple stabilization, to $202,000 per mile if a binding agent were used. The total cost to improve the road between Savage River and Wonder Lake would range from $10.9 million to $14.4 million. A ready source of gravel appropriate for the proposed stabilization could be difficult to secure given environmental concerns with gravel extraction. Costs include using material from outside the park with 20% for contingencies.

EVALUATION SUMMARY

The primary elements of each alternative are illustrated on the maps at the end of the "Executive Summary". Charts documenting the results of the evaluation process are provided for each group of alternatives. Table ES-1 shows the estimated capital cost, annual operating and maintenance expenses, and annualized cost per passenger for each alternative.

Each of the alternatives evaluated offers advantages and each has drawbacks. A critical consideration in the choice among alternatives is the level of funding that may be expected to be available in the near term and over a longer time frame. The cog railroad alternative requires a level of investment that is far beyond the current resources of Denali National Park and Preserve and the National Park Service as a whole.

Relative to the other available options, the development of a new access route into the park along the Stampede Road would yield little benefit in terms of visitor access to the primary resources of the park, would be costly to construct and maintain, and would result in unacceptable potential for habitat damage and segmentation and disturbance to wildlife.

A cog railway would reduce dust and improve comfort for visitors.

Increased demand would occur for resource protection and visitor use management. Because the route would traverse areas proposed by the Park Service for wilderness designation, an exemption from NPS management policies, which mandate that proposed wilderness areas be managed as congressionally designated wilderness, would be required. Considering its construction cost of nearly $170 million, the Stampede Road does not represent an effective investment for visitor access to Denali.

Larger buses offer the potential to significantly increase visitor carrying capacity at a relatively low cost. Operational tests of larger vehicles and more in-depth study of the structural capacity of the road should be undertaken before using such vehicles.

Table ES-1: Denali Transit Alternative Cost Estimates

	Standard Bus, No Stampede Rd.	Standard Bus, With Stampede Rd.	Large Bus, No Stampede Rd.	Large Bus, With Stampede Rd.	Cog Rail to Eielson, No Stampede Rd.	Cog Rail to Eielson, With Stampede Rd.	Cog Rail to Wonder Lake, No Stampede Rd.	Aerial Tram, Parks Hwy to Alder Pt
Construction and Equipment	$21.4 million	$194.0 million	$36.7 million	$209.3 million	$314.5 million	$482.4 million	$413.5 million	$87.2 million
Annual Operating and Maintenance	$3.2 million	$4.2 million	$3.4 million	$4.2 million	$2.7 million	$3.1 million	$3.1 million	$667 thousand
Annual Cost per Visitor	$18.61	$59.38	$17.62	$49.34	$61.66	$94.72	$80.08	$28.88

Source: BRW, Inc., Tramway cost estimates provided by CTEC, Inc., USA representatives for Garaventa Tramways, Salt Lake City Utah.

Notes:
- Equipment total costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages are applied.
- Facility total costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning
- Annual cost per visitor is based on current 111-day visitation season

The cog railway technology offers substantial advantages over buses in the long term. Visitor capacity can be adjusted by increasing the fleet of rail vehicles while maintaining vehicle volumes well below those recorded today. Implementing a cog rail system would result in a substantial reduction in wildlife and habitat disruption by permanently reducing the number of vehicle events along the park road.

The $315 million cost of a cog rail system would be substantial, as would the impacts of construction. Once in place, the cog rail system would offer cost-effective visitor transportation and a much higher level of visitor comfort compared to travel by bus.

The annualized cost per passenger of $61.66 for a cog railway to Eielson is not unreasonable when compared to the current fare ($45.00) for ARA bus service into the park and to the hundreds of dollars most visitors have invested to travel to Alaska and Denali.

The development of visitor access to the south slope and to views of the spectacular glaciers and rugged foothills in that portion of the park provides an alternative to increasing visitation in the park road corridor. Isolated areas of disturbance would result from installing a tramway system to provide visitor access, particularly at support tower locations and at the tramway base and terminal sites. The $87 million construction cost of the tramway is relatively low, compared to the cog railway alternatives, but it is still substantial relative to currently available funding.

Once installed, the system would have limited impacts on wildlife and the environment. The most significant impact of the system would be to the overall-"concept"-of the Denali wilderness as an area that contains no evidence of human impact. A tramway system would conflict with the traditional concept of wilderness, but in fact would have minimal impact on natural processes.

Providing an aerial tramway to Alder Point would encourage south slope visitation.

Long-term impacts would be associated with the development of base facilities, including visitor contact facilities, comfort stations, and parking at a minimum. Other functions may be appropriate to consider at the base area, with their own associated permanent impacts.

The tramway system would not represent a barrier to wildlife movement and would effectively isolate visitors from the environment while providing excellent viewing opportunities. The aerial tramway offers a cost-effective means to transport relatively large numbers of visitors to locations with a great deal of visitor appeal.

IMPLEMENTATION ISSUES

This study is not intended to produce a recommended alternative for visitor transportation in Denali. The purpose of the effort to date has been to identify a range of feasible alternatives that should be analyzed in more detailed planning and engineering studies.

It appears that each of the bus and cog rail alternatives are worthy of more detailed study, as is a system to provide visitor access on the south slope. Funding availability will be a major

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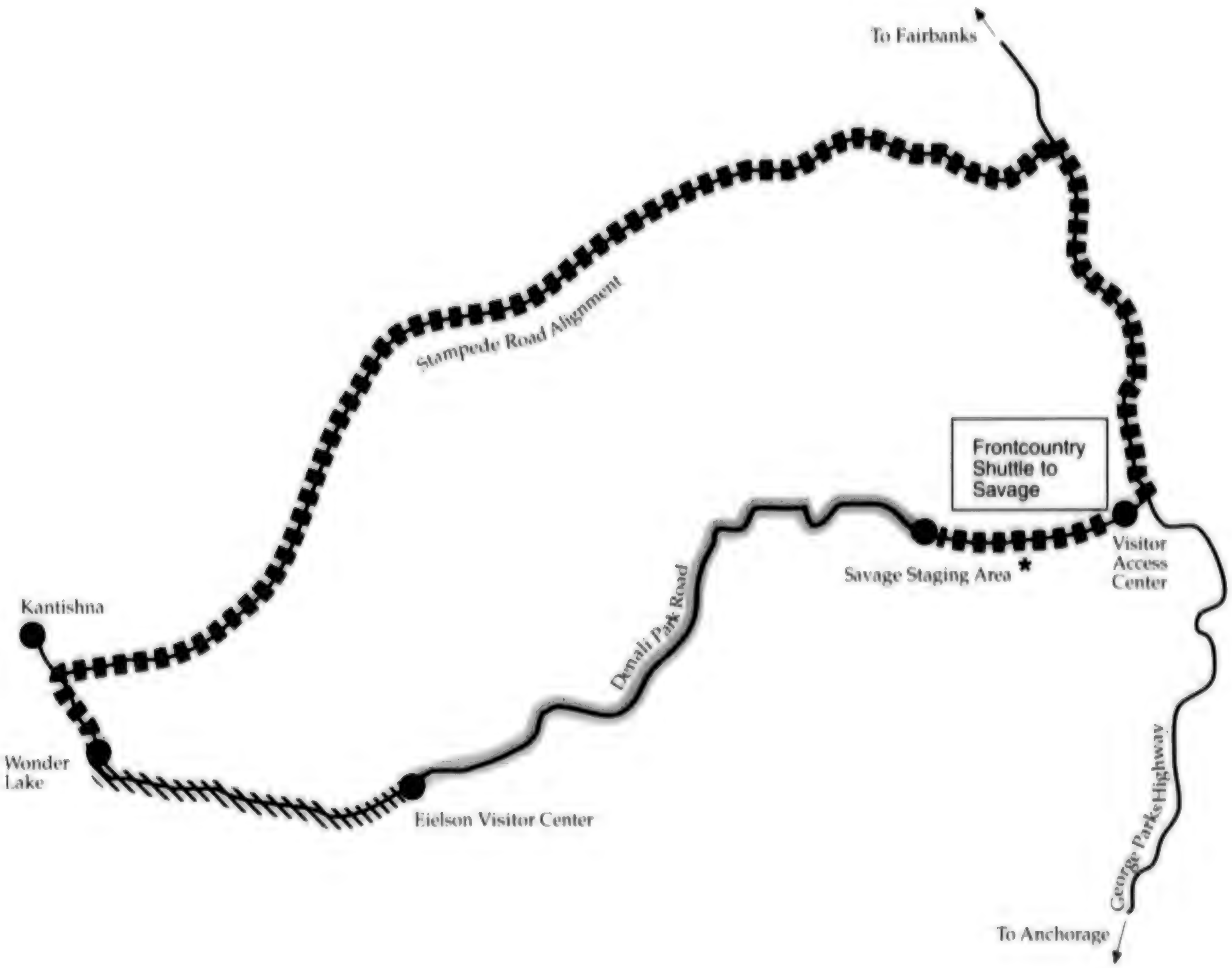
consideration in deciding how to proceed with improvements for visitor transportation in Denali. Private sector participation in development of the project could be realized if the revenue from potential user fees and related concession revenues is sufficient to offset the costs of the system. The ability of a private operator to generate the necessary revenues would depend on changes in the present NPS policy of keeping entrance fees low and providing VTS services without directly charging users.

In considering how to provide for increasing visitor use over time, a phased development approach that combines elements of each of the VTS alternatives analyzed in this report could address the immediate needs of the park within currently available financial resources and would allow flexibility to respond to changing needs in the future.



BUS TRANSIT ALTERNATIVES

LEGEND

▬ EIELSON BUS ROUTE

▨ WONDER LAKE BUS ROUTE EXTENSION

■■■■■ RETURN BUS ROUTE VIA STAMPEDE ROAD

* BUS ALTERNATIVES COULD USE EXPANDED VISITOR ACCESS CENTER FOR STAGING AREA

Not to Scale

N

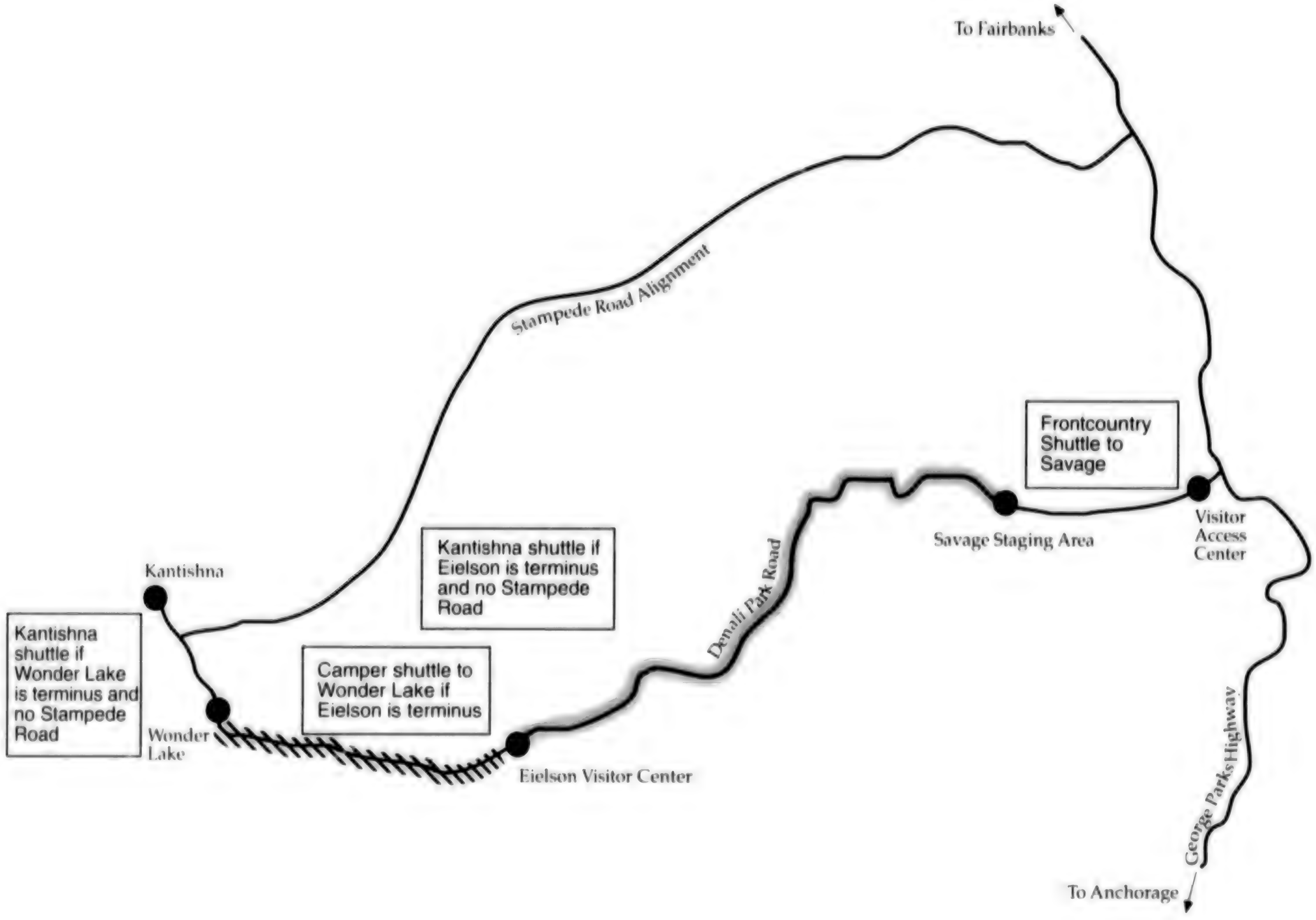
DENALI
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE • DSC APRIL 94 [illegible]

EVALUATION SUMMARY CHART
BUS VTS ALTERNATIVES

	Standard Bus (52 Pass.) No Stampede Road	**Standard Bus (52 Pass.) With Stampede Road**	**Large Bus (72 Pass.) No Stampede Road**	**Large Bus (72 Pass.) With Stampede Road**
Visitor Transportation and Management				
Daily Visitors Served	**3,821 (17% more than existing)**	**4,673 (42% more than existing)**	**5,490 (66% more than existing)**	**6,080 (85% more than existing)**
Access to Key Locations	Requires frontcountry shuttle to Savage for overnight visitors	Alternate access for backcountry users on Stampede Road Requires frontcountry shuttle to Savage for overnight visitors No transit requirements for Kantishna visitors on park road	Requires frontcountry shuttle to Savage for overnight visitors	Alternate access for backcountry users on Stampede Road Requires frontcountry shuttle to Savage for overnight visitors **No transit requirements for Kantishna visitors on park road**
Visitor Experience				
Views	**Buses could be modified to blend into surroundings and provide better views with more window space**	**Buses could be modified to blend into surroundings and provide better views with more window space**	**Buses could be modified to blend into surroundings and provide better views with more window space**	**Buses could be modified to blend into surroundings and provide better views with more window space**
Comfort	Could be improved slightly	Could be improved slightly	Could be improved slightly	Could be improved slightly
Character	Same basic character	Same basic character	Same basic character	Same basic character
Other	Activity disturbance to Savage campground users Dusty roads impact views	Activity disturbance to Savage campground users Dusty roads impact views	Activity disturbance to Savage campground users Dusty roads impact views	Activity disturbance to Savage campground users Dusty roads impact views
Resource Impact				
Peak Daily One-Way Vehicle Trips Past Primrose	**208 (same as existing)**	**184 (24 or 11.5% less than existing) Divert Kantishna traffic from wilderness corridor**	**208 (same as existing)**	**178 (30 or 14% less than existing) Divert Kantishna traffic from wilderness corridor**
Wilderness Encroachment	**13.7 acres at Savage**	**14.0 acres at Savage**	**15.7 acres at Savage**	**17.4 acres at Savage**
Wildlife, Vegetation, Water, Soils, Air		**Permanent segmentation of pristine park habitat Increased potential for poaching Impacts on natural vegetation in Stampede corridor**	Potential increase in road maintenance material source requirements in park due to heavier buses	Potential increase in road maintenance material source requirements in park due to heavier buses **Permanent segmentation of pristine Park habitat Increased potential for poaching Impacts on natural vegetation in Stampede corridor**
Cultural		**Probable archeological and historic disturbance in Kantishna and along the Stampede Road corridor**		**Probable archeological and historic disturbance in Kantishna and along the Stampede Road corridor**
Construction Impacts	Impacts in and outside park from material excavation and importation activities	Impacts in and outside park from material excavation and importation activities **Two seasons of wildlife disturbance in Stampede corridor** Water quality and resource impacts in Stampede corridor Construction crew housing required	Impacts in and outside park from material excavation and importation activities	Impacts in and outside park from material excavation and importation activities **Two seasons of wildlife disturbance in Stampede corridor** Water quality and resource impacts in Stampede corridor Construction crew housing required
Consistency With NPS and Regional Planning Goals				
Park Management	**Reservation system required for efficient operation** Could be exclusively operated by concessioner	Major development pressures in Kantishna **Reservation system required for efficient operation** Could be exclusively operated by concessioner **Major new area to patrol for resource protection and visitor needs**	**Reservation system required for efficient operation** Could be exclusively operated by concessioner **Possible single track operations required in narrow sections**	Major development pressures in Kantishna **Reservation system required for efficient operation** Could be exclusively operated by concessioner **Major new area to patrol for resource protection and visitor needs Possible "single track" operations required in narrow sections**
Offsite Impacts	More hotel rooms for package tours (17%) Non-tour overnight demand could decline with reservation system	More hotel rooms for package tours (42%) Some non-tour overnight demand increase, offset by reservations system **Major gravel source and delivery requirements Residential area to Eight Mile Lake impacted by Stampede Road traffic Development pressure in Wolf Townships**	More hotel rooms for package tours (66%) Some non-tour overnight demand increase, offset by reservations system Some additional gravel source and delivery requirements	More hotel rooms for package tours (85%) Some non-tour overnight demand increase, offset by reservations system **Major gravel source and delivery requirements Residential area to Eight Mile Lake impacted by Stampede Road traffic Development pressure in Wolf Townships**
Cost and Cost Effectiveness				
Construction and Equipment Costs	$21.4 million (62 buses)	$194.0 million (75 buses)	$36.7 million (63 buses)	$209.3 million (70 buses)
Annual Operating and Maintenance Costs	$3.2 million	$4.2 million	$3.4 million	$4.2 million
Annualized Cost/Visitor	**$18.41**	**$59.38**	**$17.42**	**$49.34**
Implementation				
Compliance Issues	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel excavation	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel excavation Major EIS for Stampede Road corridor Requires wilderness management exemption	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel excavation	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel excavation Major for Stampede Road corridor Requires Wilderness management exemption
Number of Employees	**161 transportation employees**	**Probable increase in ranger and interpretation staff needed for higher visitor levels Additional maintenance staff required for Stampede Road 208 transportation employees**	**Probable increase in ranger and interpretation staff needed for higher visitor levels Potential increase in maintenance staff due to heavier axle loads 164 transportation employees**	**Probable increase in ranger and interpretation staff needed for higher visitor levels Potential increase in maintenance staff due to heavier axle loads Additional maintenance staff required for Stampede Road 199 transportation employees**

COG RAILWAY TRANSIT ALTERNATIVES


To Fairbanks
Stampede Road Alignment
Frontcountry Shuttle to Savage
Savage Staging Area
Visitor Access Center
Kantishna shuttle if Eielson is terminus and no Stampede Road
Kantishna
Kantishna shuttle if Wonder Lake is terminus and no Stampede Road
Camper shuttle to Wonder Lake if Eielson is terminus
Denali Park Road
Wonder Lake
Eielson Visitor Center
George Parks Highway
To Anchorage

LEGEND

▒ EIELSON COG RAIL ROUTE

▨ COG RAIL EXTENSION TO WONDER LAKE

Not to Scale

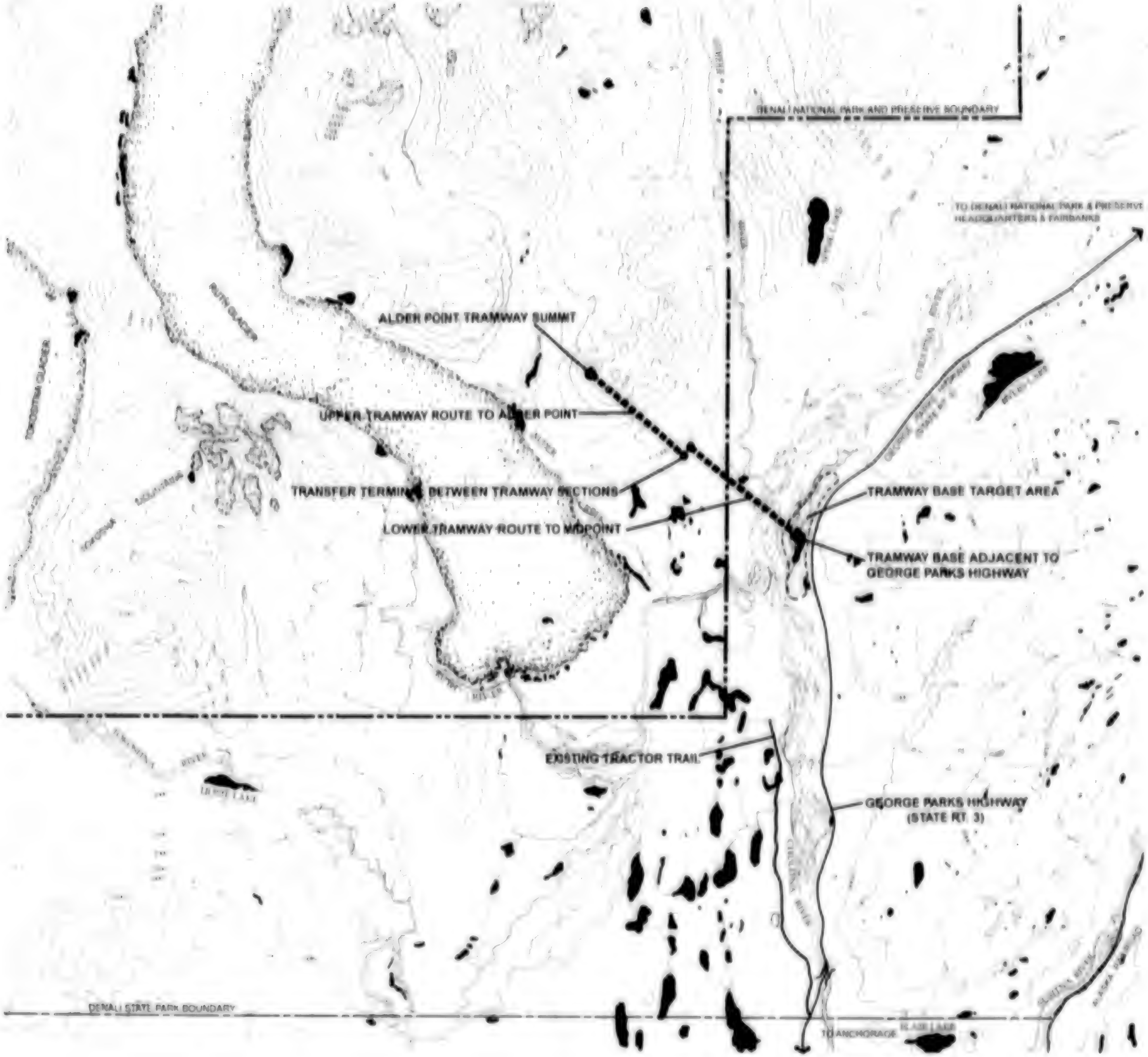
N

D E N A L I
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC/APRIL 94/184/[illegible]

COG RAILWAY VTS ALTERNATIVES

	Cog Rail (316 Pass.) to Eielson, Replacing Existing Road, No Stampede Road	Cog Rail (316 Pass.) to the Eielson, Replacing Existing Road, With Stampede Road	Cog Rail (316 Pass.) to Wonder Lake, Replacing Existing Road, No Stampede Road
Visitor Transportation and Management			
Daily Capacity (visitors)	4,000 (42% more than existing) More seats Kantishna and miscellaneous visitors	4,000 (42% more than existing)	4,000 (42% more than existing) More seats Kantishna and miscellaneous visitors
Access to Key Locations	Requires frontcountry shuttle to Savage for overnight visitors Requires shuttle from Eielson for overnight visitors and Kantishna visitors **No public access beyond staging areas during construction (2+ seasons; stages of access could occur)** Less prone to closure due to structure failure of guideway **No Kantishna access via park road corridor during initial construction**	Requires frontcountry shuttle to Savage for overnight visitors Requires shuttle from Eielson for overnight visitors No transit requirements for Kantishna visitors Alternate access for backcountry users via Stampede Road **No public access beyond staging areas during construction (2+ seasons; stages of access could occur)** Less prone to closure due to structure failure of guideway **No Kantishna access via park road corridor during initial construction**	Requires frontcountry shuttle to Savage for overnight visitors Requires shuttle from Wonder Lake for Kantishna visitors **No public access beyond staging areas during construction (2+ seasons; stages of access could occur)** Less prone to closure due to structure failure of guideway **No Kantishna access via park road corridor during initial construction**
Visitor Experience			
Comfort	**More comfortable than buses**	**More comfortable than buses**	**More comfortable than buses**
Character	More in character with mountain experience	More in character with mountain experience	Less in character with mountain experience
Other	Eliminates special access for private vehicles Requires transfers to Wonder Lake and Kantishna **Eliminates dust** Disturbance to Savage campground users	Eliminates special access for private vehicles Requires transfers to Wonder Lake **Eliminates dust** Disturbance to Savage campground users	Eliminates special access for private vehicles Requires transfers to Kantishna **Eliminates dust** Disturbance to Savage campground users
Resource Impact			
Peak Daily One-Way Vehicle Trips Past Primrose	**46 (182 or 79% less than existing)**	**44 (184 or 79% less than existing)**	**46 (182 or 78% less than existing)**
Peak Daily One-Way Vehicle Trips Between Eielson and Wonder Lake	**44 (46 or 51% less than existing)**	**30 (60 or 33% less than existing)** **Direct Kantishna traffic from wilderness corridor**	**46 (44 or 49% less than existing)**
Wilderness Encroachment	**18.9 acres at Savage** Possible minor encroachment in restricted areas Shuttle maintenance facility required at Eielson for Wonder Lake segment	**17.7 acres at Savage** Possible minor encroachment in restricted areas Shuttle maintenance facility required at Eielson for Wonder Lake segment	**19.5 acres at Savage** Possible minor encroachment in restricted areas Shuttle maintenance facility required at Eielson for Wonder Lake segment
Wildlife, Vegetation, Water, Soils, Air	**Healing of existing road edge habitat by elimination of dust and grading** **Significantly fewer vehicle events would decrease wildlife disturbance** Activity at tourist rest stops would cause habitat disturbance due to social trail formation and noise Larger fuel storage requirements at terminals and increased potential for spills	**Healing of existing road edge habitat by elimination of dust and grading** **Significantly fewer vehicle events would decrease wildlife disturbance** Social trail development at staging area and stations Activity at tourist rest stops would cause habitat disturbance due to social trail formation and noise Larger fuel storage requirements at terminals and increased potential for spills **Permanent segmentation of pristine park habitat** **Increased potential for poaching** **Impacts on vegetation in Stampede corridor**	**Healing of existing road edge habitat by elimination of dust and grading** **Significantly fewer vehicle events would decrease wildlife disturbance** Social trail development at staging area and stations Activity at tourist rest stops would cause habitat disturbance due to social trail formation and noise Larger fuel storage requirements at terminals and increased potential for spills
Cultural		**Probable disturbance to archeological and historic disturbances in Kantishna and along the Stampede Road corridor**	
Construction Impacts	Impacts in and outside park from gravel excavation and importation activities Water quality impacts, noise, equipment emissions, and dust would occur from construction staging **Two seasons of wildlife disturbance and displacement during construction** Construction could be slowed by wildlife migration, archeological sites, and other environmental concerns Construction crew housing required	Impacts in and outside park from gravel excavation and importation activities for two major projects Water quality impacts, noise, equipment emissions, and dust would occur from construction staging in Park road and Stampede corridor **Two seasons of wildlife disturbance and displacement during construction in park road and Stampede corridors** Construction could be slowed by wildlife migration, archeological sites, and other environmental concerns Construction crew housing required for two separate projects	Impacts in and outside park from gravel excavation and importation activities Water quality impacts, noise, equipment emissions, and dust would occur from construction staging **Two seasons of wildlife disturbance and displacement during construction** Construction could be slowed by wildlife migration, archeological sites, and other environmental concerns Construction crew housing required
Consistency with Park Service and Regional Planning Goals			
Park Management	**Reservation system required for efficient operation** Turnbox operation possible **Requires assessment of NPS user fee policy** More control over Kantishna access	**Reservation system required for efficient operation** Turnbox operation possible **Requires assessment of NPS user fee policy** **Major development pressures at Kantishna** **Major new area to patrol for resource protection and visitor needs**	**Reservation system required for efficient operation** Turnbox operation possible **Requires assessment of NPS user fee policy** More control over Kantishna access
Offsite Impacts	Major hotel demand increase (15%) **Major gravel source and delivery requirements**	Major hotel demand increase (15%) **Major gravel source and delivery requirements for two separate projects** **Residential area in Eight Mile Lake impacted with additional Stampede Road traffic** **Development pressure in Wolf Township**	Major hotel demand increase (15%) **Major gravel source and delivery requirements**
Cost and Cost Effectiveness			
Construction and Equipment Costs	$314.5 million (20 cog vehicles, 7 buses)	$482.4 million (24 cog vehicles, 7 buses)	$413.5 million (26 cog vehicles, 4 buses)
Annual Operating and Maintenance Costs	$2.7 million	$3.1 million	$3.1 million
Annualized Cost/Visitor	**$81.00**	**$94.72**	**$80.68**
Implementation			
Compliance Issues	**Major controversial EIS and design effort for staging area and rail alignment** DCP/EA for related facilities and any gravel excavation	**Major controversial EIS and design effort for staging area, rail alignment, and Stampede alignment** DCP/EA for related facilities and any gravel excavation **Requires wilderness management exemption**	**Major controversial EIS and design effort for staging area and rail alignment** DCP/EA for related facilities and any gravel excavation
Number of Employees	**New transit mode requires specialized labor** **Probable increase in ranger and interpretative staff needed for higher visitation levels** **99 transportation employees**	**New transit mode requires specialized labor** **Probable increase in ranger and interpretative staff needed for higher visitation levels** **Additional maintenance staff required for Stampede Road** **116 transportation employees**	**New transit mode requires specialized labor** **Probable increase in ranger and interpretative staff needed for higher visitation levels** **108 transportation employees**

SOUTH SLOPE AERIAL TRAMWAY ALTERNATIVE


DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE HEADQUARTERS & FAIRBANKS
ALDER POINT TRAMWAY SUMMIT
UPPER TRAMWAY ROUTE TO ALDER POINT
TRANSFER TERMINAL BETWEEN TRAMWAY SECTIONS
LOWER TRAMWAY ROUTE TO MIDPOINT
TRAMWAY BASE TARGET AREA
TRAMWAY BASE ADJACENT TO GEORGE PARKS HIGHWAY
EXISTING TRACTOR TRAIL
GEORGE PARKS HIGHWAY (STATE RT. 3)
DENALI STATE PARK BOUNDARY
TO ANCHORAGE
CHULITNA RIVER
ALASKA RAILROAD

0 1 2 4 MILES

N

D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

EVALUATION SUMMARY CHART
SOUTH SLOPE TRAMWAY VTS ALTERNATIVE

	Tramway to Alder Point
Visitor Transportation and Management	
Daily Visitors Served	4,800 - 4,800 daily passengers Could potentially reduce visitation demand along park road corridor
Visitor Experience	
Views	Mt. McKinley, Ruth Glacier and Tokosha Mountains views Wildlife viewing from plane Views from road disrupted by towers
Other	Easy access from Anchorage Unusual experience
Resource Impact	
Wilderness Fragmentation	New corridor into undisturbed area Total length = 5.5 miles, 1 to 10 towers Excavation staging area requirements along alignment
Wildlife, Vegetation, Soil and Water	Activity at tram staging areas would reduce areas from development and increased wildlife disturbance from human access Potential effects on raptors and birds at Chulitna River Impacts from transmission of power Effects on aesthetic qualities of undisturbed wilderness 2.2 acres of parking required
Construction Impacts	Construction would impact wildlife, vegetation, and possibly archeological resources Sedimentation during construction could impact fisheries and aquatic habitat One season of wildlife disturbance and displacement would occur Sensitive construction methods could potentially reduce impacts
Consistency with Park Service & Regional Goals	
Park Management	Reservation system required for efficient operation New area for ranger patrols use Additional staff requirements for interpretation and visitor protection responsibilities
Off-Site Impacts	Development pressure in Denali State Park and Talkeetna New power source requirements
Cost and Cost Effectiveness	
Construction and Equipment Costs	$47.2 Million 12 towers, 2 terminals, 4 passenger cabins
Annual Operating and Maintenance Costs	$867,000
Annualized Cost/Visitor	$20.00
Associated Power Source Costs (included in construction and equipment costs)	Requires access to Anchorage/Fairbanks intertie Approximately 13-mile construction of distribution line ($100,000/mile) 30 to 40 ft. right-of-way likely required for distribution line Substation required at a cost in the range of $1.5 million
Implementation	
Compliance Issues	EIS required for construction and permanent changes to wilderness area Coordination with Denali State Park Requires wilderness management revisions
Number of Employees	29 transportation employees

PROBLEM STATEMENT

Denali National Park and Preserve is unique among units of the national park system. The park affords visitors an opportunity to experience vast areas of unspoiled wilderness on a personal basis, along with unmatched scenery and diverse and abundant wildlife - all in conditions that are as free from man's influence as is possible while still providing for visitor access.

The park road provides the primary means of visitor access to the park.

Most visitor access to Denali is provided by the 92-mile Denali Park Road, which is largely unpaved. Sections of narrow, winding, and steep roadway make the road inappropriate and unsafe for high volumes of vehicle travel. The road corridor traverses a broad valley characterized by abundant wildlife and spectacular scenery.

A delicate balance between accessibility, preservation of park resources, and provision for visitor enjoyment and resource interpretation is maintained at Denali by restricting private vehicular traffic and providing a carefully managed array of visitor transportation systems (VTS). Most visitors to Denali are making a once-in-a-lifetime trip to Alaska. The sense of adventure for visitors to Denali is heightened by the character of the park road, the flow of events during shuttle and tour trips, and the immense scale of the landscape, which seems to swallow up the road and the small buses that operate along it.

SERVICE TO DENALI VISITORS

The park road and the VTS services operating along it provide several important functions that contribute to the unique character of the park. These include:

- the capability to move through the park with minimal disruption to wildlife and with limited impact to the visual character of the surroundings
- the ability to stop as wildlife viewing opportunities arise, without regard to precise schedules
- the ability to view wildlife at close range and in a variety of settings

The ability to stop for wildlife viewing and photography is crucial.

- the ability to pick up and discharge passengers freely along the route, allowing visitors to experience the park on their own terms
- the ability to carry camping and backpacking equipment for use by overnight visitors
- the ability to serve passenger demands while contributing to the overall sense of adventure and the wilderness character of the park

Any alternative transportation system should provide these basic functions to be effective in serving visitor needs within Denali.

CRITICAL RESOURCES

Alternatives to the existing bus systems and visitor access systems in new areas of the park also must preserve the critical natural resources within the park. The most critical resources and areas in Denali include the following:

- 6 million acres of continuously protected, undisturbed ecosystem, including designated wilderness areas surrounding the park road corridor
- the abundant and diverse wildlife population within the park road corridor
- concentrated bear denning and use areas, including the front country spruce forest in the spring and broad areas of the south slope and Sable Pass from spring through fall
- water quality and aquatic habitat of Igloo, Moose, Caribou, Little Stony, Hogan, and Jenny creeks, the Sanctuary River, and tributaries to the East Fork, Toklat, Teklanika, and Chulitna rivers
- wildlife use corridors along the Savage, Sanctuary, Toklat, Teklanika, and Chulitna Rivers

The wilderness character of Denali must be maintained

- trumpeter swan and eagle use of the Chulitna River corridor and south slope wetlands in summer
- caribou east-west migration through the central valley of the park and Dall sheep north-south migrations from the north slopes of the Alaska Range to the Wyoming Hills
- the Teklanika Archaeologic District and historic structures in the park headquarters area and in Kantishna
- the pristine conditions and scenic quality of most of the park, specifically, views of Mt. McKinley, the Alaska Range, and wildlife

ADMINISTRATIVE NEEDS

Along with serving Denali visitors and preserving its resources, the road fulfills other administrative and access functions. These include:

- access for park employees working in the road corridor and for employees with living quarters along the corridor

- delivery of supplies to ranger stations, rest stops, Eielson Visitor Center, and other facilities

- removal of waste and trash from rest areas and campgrounds

- access and circulation for park safety patrols

- access to private inholdings in Kantishna in conformance with the Alaska National Interest Land Conservation Act

The need for NPS support activities will likely increase if access to the park is provided for more visitors. Additional visitor-oriented development in Kantishna has been a subject of concern to the National Park Service for some time. Substantial increases in the need for visitor access could dictate major changes in bus operations and a reduction in access to the park interior for those not staying at Kantishna. Preliminary studies of the feasibility of providing additional access to Kantishna have been conducted by the state and by private parties. These studies have considered roadway and railroad access options along a route north of the Wyoming Hills known as the Stampede Trail. The Park Service has been opposed to the development of a new access and expanded tourism development in Kantishna because of conflicts with the basic purpose of the park.

VISITOR TRANSPORTATION

Since 1972, restrictions on private vehicles and a system of shuttle and tour buses have allowed a steady increase in visitor trips to be accommodated while maintaining a high quality experience for visitors and allowing continued undisturbed use of the road corridor by the park's plentiful wildlife. Visitation to Denali has doubled since 1980, accompanied by a 40% increase in bus travel along the park road between 1984 and 1988. The daily volume of bus traffic has reached its practical limit and has remained stable since 1989.

Bunching of buses at wildlife viewing stops occurs on a regular basis. Dust and noise from vehicles along the park road is a minor nuisance that could become a major problem if more bus trips were to be made.

The current system of school buses used by the NPS contractor is functional and cost-effective; however, to at least some of the passengers, the school buses are perceived as uncomfortable. The concessioner's Bluebird buses and the NPS school buses have small windows compared to other types of buses, limiting visibility for some passengers. Dust along the road is causing localized impacts to vegetation and can periodically obscure close-range views and intrude on park vistas.

Despite these inconveniences, the existing system of transporting visitors in and around Denali has served the park well since its establishment in 1972. However, growth in visitation has strained the system's ability to provide a quality experience to visitors.

The ARA wilderness tour is at 99% of capacity. This portion of the concessioner's operation can accommodate only a small amount of additional growth through conversion of the fleet to larger buses. The ARA natural history tour provides some opportunity to address future visitor needs by providing a more limited, but still valuable experience. The occupancy of the natural history tour system as currently operated is 70%. Additional buses could be operated with minimal impact to the environment and wildlife of the park.

The NPS shuttle system also has very little spare passenger capacity. Some opportunity exists to increase ridership by refining the operation and by using an improved reservation system to reduce no-shows. At present, one- to two-day waits for shuttles are common. Many visitors arrive at the park with no knowledge of the reservation system and have not planned for a delay of this duration. The long waits for access to the shuttle bus system result in about one in five park visitors being unable to make a trip into the park interior.

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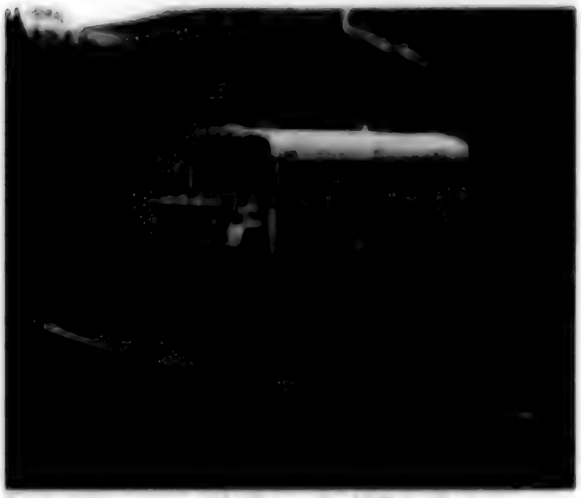


Opportunities exist to add riders to the NPS shuttle system.

Crowding and soil compaction are problems at rest areas.

Without investment in a reservation system, only a small increase in visitation to the park interior can be accommodated on the shuttle system. Any growth in use without a change in reservation practices would probably result in further lengthening of the already inconvenient wait for access to the park interior.

The visitor access center (VAC) parking lot is fully occupied for several hours each afternoon. Much of the use is for long-term parking, possibly displacing parkers who need to access the center for reservations. Meanwhile, parking spaces are generally available at Riley Creek. A free bus links the center with Riley Creek parking.

VISITOR AND RESOURCE ISSUES

The rest stops along the park road and the Eielson Visitor Center are busy and sometimes overcrowded under current conditions. The portable toilets detract from the otherwise pleasant environment of the rest areas, except at the newly improved Polychrome Pass facility. Substantial growth in visitation will require expansion and improvement of these facilities.

Concentrated foot traffic is now beginning to result in the formation of social trails and attendant soil compaction and disturbance of vegetation. To accommodate more visitors, formal trail development and methods to manage the movement of visitors could be required in areas of concentrated use.

High demand levels and long waits for access to the shuttle system are putting increased pressure on overnight accommodations in and outside the park. Nearly all hotel accommodations are used by package tour visitors traveling into the park on the ARA tours. The camping facilities in the park and the surrounding area serve the remaining visitors, who represent just under half of all visitation.

The necessary wait for seats on the NPS shuttles results in visitors staying one to two days longer than would otherwise be the case. About 300 to 500 extra overnight units are required at the current level of visitation because of the longer visitor stays. Campground facilities in the park are perpetually full.

Crowding at camping areas is a result of the long waits for shuttle rides.

IMPLEMENTATION CHALLENGES

The park's topography and environment will place severe demands on alternative transportation systems. Steep grades and sharp curves will make it difficult to follow the road alignment in many locations. Some technologies would likely need to leave the corridor of wilderness exclusion to maintain acceptable grades and curvature.

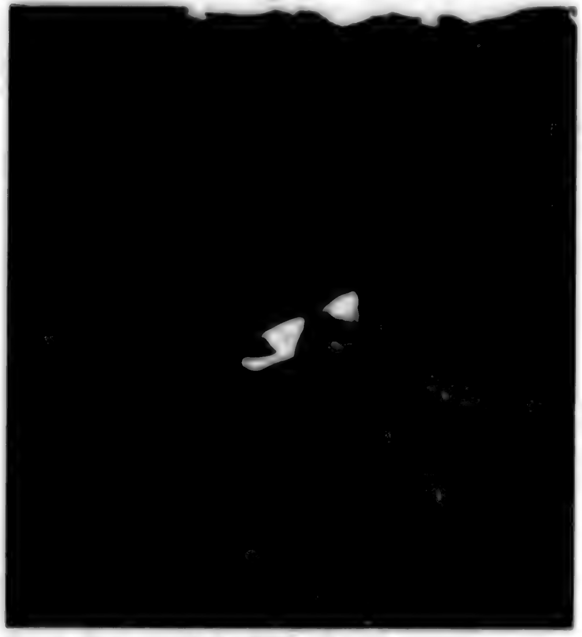
The construction of any improvements will be made more challenging by the presence of variable soil quality, intermittent permafrost, and the difficulty of obtaining construction materials.

Electric power for a new transportation system can be made available from either a power plant at Healy or the Anchorage-Fairbanks tie line that parallels the Chulitna River, but at substantial cost and disruption. The remote location of the park is likely to increase the cost of any equipment and material required to develop a new transportation system.

PARK OVERVIEW

REGIONAL CONTEXT

Denali National Park and Preserve is located in south central Alaska (see map on following page), 240 miles north of Anchorage and 120 miles south of Fairbanks on Alaska Highway 3 (George Parks Highway). Denali can be reached by tour bus from both cities. Daily service to the park on the Alaska Railroad also is available from both Fairbanks and Anchorage during the peak season. A landing strip at Riley Creek accommodates small planes.



Denali offers unmatched wildlife and scenic viewing opportunities

The closest community to the park is Healy, a small town with limited commercial services about 12 miles north of the park entrance. The town of Cantwell is 26 miles south of the park entrance at the intersection of the George Parks Highway and the Denali Highway (Alaska Highway 8). The Denali Highway is a gravel road that connects Cantwell with the Richardson Highway (Alaska Highway 4) some 125 miles to the east. The town of Talkeetna is about 120 miles south of the park entrance. It is the service center for climbing Mount McKinley and the location of the airport for flights to the climbing staging area on the mountain.

PARK PURPOSE

Denali National Park and Preserve was originally dedicated as Mount McKinley National Park in 1917. Providing access to and preserving Mount McKinley's scenery and wildlife were the primary reasons for setting aside the 2-million-acre area as a national park. Consistent with the mandate of the National Park Service established just one year earlier, Congress specified that the park was to be managed as a game refuge, to preserve wildlife, natural curiosities, and scenic beauties for the benefit and enjoyment of the public. The 1980 Alaska National Interest Land Conservation Act expanded the park by 4 million acres and redesignated it Denali National Park and Preserve.

Denali National Park and Preserve contains more than 6 million acres and is managed as three separate units, each with separate regulations, as summarized in table 1, below and shown on the attached map.

Table 1: Denali Lands by Status

	Acres
National Park	
Wilderness	2,124,783
Nonwilderness	2,591,943
Total	4,716,726
National Preserve	1,311,365
Total Park and Preserve	6,028,091

Source: Denali Land Protection Plan, 1986

Denali Wilderness - with 2.1 million acres, this portion includes most of the original Mount McKinley National Park. The area is managed under the Wilderness Act of 1964, which regulates backcountry use and prohibits hunting, mining, and motorized vehicles (with certain exceptions permitted under the Alaska National Interest Land Conservation Act).

Denali National Park - The park (excluding Denali wilderness) totals 2.6 million acres.

Subsistence hunting and trapping is allowed in this area, recognizing a long standing dependence on wildlife, fish, and plant materials for subsistence in rural Alaska.

Denali National Preserve - The preserve, comprising 1.3 million acres on the southern and western edges of the park, also permits the subsistence uses allowed in Denali National Park. Additionally, sport hunting is allowed by state permit.

In 1988 an additional 2,254,000 acres of the nonwilderness portion of the national park lands were proposed for wilderness designation by the National Park Service. NPS policy requires proposed wilderness lands to be managed as if they were designated wilderness areas. Any development in these areas of the park would require an exemption from that policy.

Wildlife is the primary source of enjoyment for many visitors.

MAJOR RESOURCES

Denali contains resources of international significance - the highest mountain on the North American continent and a very large, continuously protected ecosystem. For this reason, it has gained international recognition through its designation as a biosphere reserve under the Man and the Biospnere program of the United Nations. Denali is a popular destination, known for it views of Mount McKinley, and for its wildlife viewing within a wilderness environment. It is the only place in the national park system where visitors can consistently expect to see caribou, Dall sheep, moose, and grizzly bears - the big four of Alaskan wildlife -in a single day of travel. Because of the unpredictable weather conditions, some visitors may not see Mt. McKinley during their trip to the park, making wildlife viewing the primary source of enjoyment for many.

Vehicular access to the park is along the Denali park road, an unpaved (except for the first 15 miles) 92-mile road on the north side of Mount McKinley that was completed in 1938. To preserve habitat and wildlife viewing and to provide for public safety, most private vehicles have been prohibited from using the park road beyond Savage River (mile 14.8) since the opening of paved highway access to the park via the George Parks Highway in 1972. Recreational travel in the park is now limited to NPS shuttles and concessioner-operated tour buses.

The expansion of the park in 1980 included the south side of Mount McKinley and the Alaska Range, which has considerably different landscape features and resource characteristics than the north side. Providing access to this area, which features rugged mountain terrain, numerous large glaciers, and forest habitat, would provide additional opportunities for visitor use and would increase the visitation capacity of the park without threatening the unique wilderness habitat along the existing park road.

PARK ENVIRONMENT

Topography

The Denali area is dominated by Mount McKinley, centered along a northeast to southwest ridge of mountains known as the Alaska Range. The Alaska Range forms the northernmost portion of the Pacific mountain system and has the greatest vertical rise in North

America - from the lowlands at 2,000 feet to the pinnacle of Mount McKinley at 20,320 feet.

Mt McKinley dominates the Alaska Range

A series of rugged and glaciated mountain ridges comprise the Alaska Range. Near Mount McKinley, numerous peaks stand at elevations of 10,000 to 13,000 feet. Mount Foraker, 14½ miles southwest of McKinley, the second highest peak in Denali, is 17,400 feet. Nearby Mount Hunter, third highest in the park and preserve, is 14,573 feet. The range is perpetually snowclad above 7,000 feet on the north and 6,000 feet on the south. Glaciers are numerous and tend to be larger and longer on the south side of the range than on the north. The larger glaciers range between 35 and 45 miles in length, including the Kahiltna, Ruth, Eldridge, Tokositna and Yentna glaciers. The largest glacier on the north side is the 34-mile-long Muldrow Glacier.

The northern foothills of the Alaska Range consist of a series of east-trending ridges, starting with the Kantishna Hills and running eastward. Summit altitudes range generally between 2,000 and 4,500 feet. The foothills vary from 3 to 7 miles in width and from 5 to 20 miles in length. They are separated by broad flat valleys of glacial origin, which range from 2 to 10 miles in width. The southern foothills are generally quite steep and are cut through by large south-flowing glaciers extending to near the valley floor. The foothills and glaciers are easily visible from the George Parks Highway, which follows the eastern Denali National Park boundary.

Climate

Denali National Park and Preserve lies within two major climate zones of Alaska, which are separated by the Alaska Range. To the north the climate is continental, characterized by extremes in temperature, calm air movements, and light precipitation. To the south a maritime climate is influenced by the Pacific Ocean and the Gulf of Alaska. Strong winds, heavy precipitation, and less seasonal fluctuation in temperature characterize the south slope weather patterns.

Rugged foothills and large glaciers are found on the south slope of the Alaska Range.

Precipitation is greater on the south side of the Alaska Range than on the north side and greater in summer than in winter for the entire region. Precipitation occurs on an average of 21 days during June, July, and August at the Denali and Lake Minchumina recording stations, on 45 days at the Mt. McKinley summit and on 36 days at Talkeetna. The average annual precipitation at park headquarters is slightly in excess of 15 inches. Annual snowfall there averages 75.7 inches.

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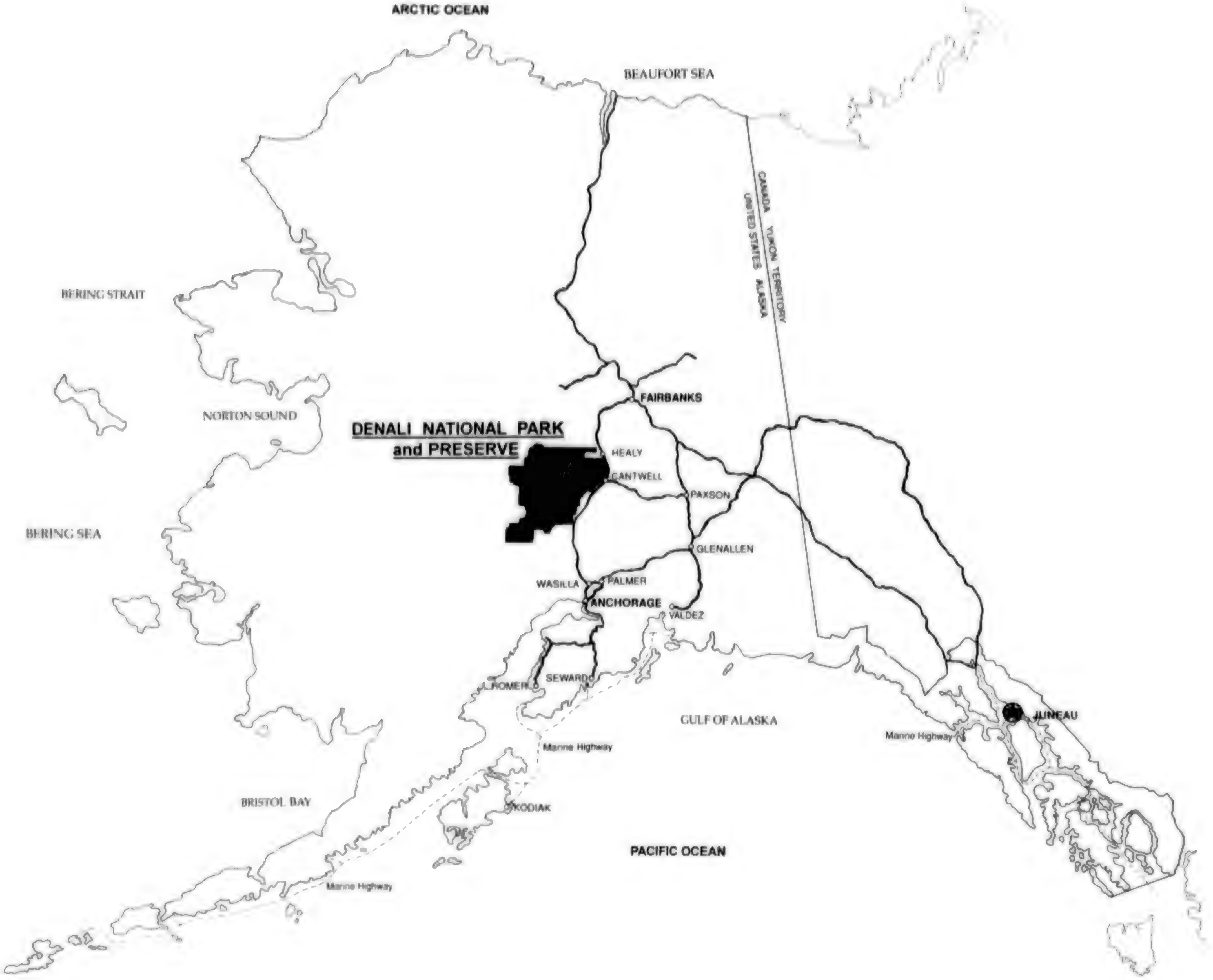
VICINITY MAP



LEGEND:

- STATE OR CANADIAN HIGHWAY
- MARINE HIGHWAY

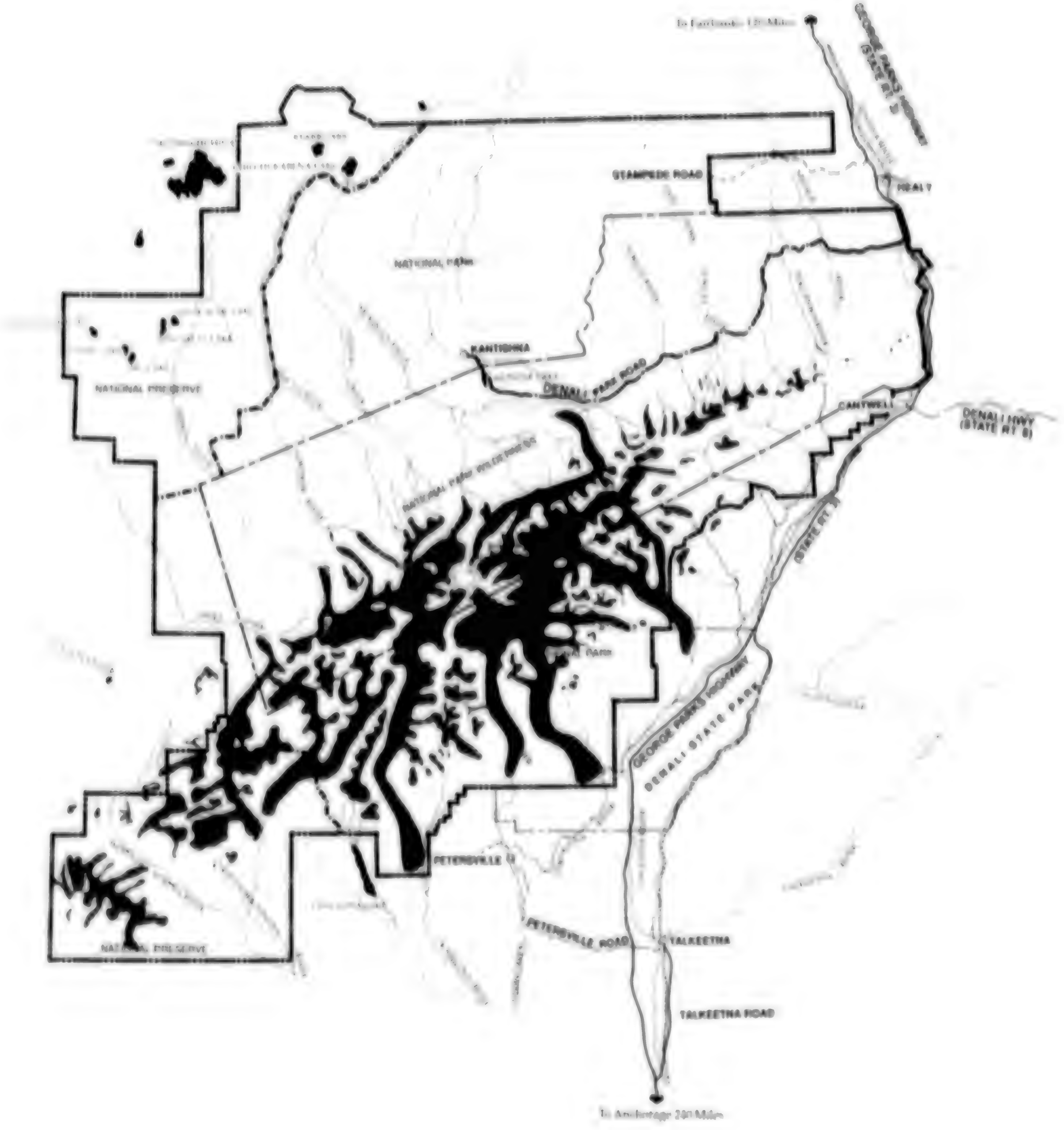
D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC/APRIL 94 184 20056B

PARK OVERVIEW



LEGEND:

- DENALI NATIONAL PARK BOUNDARY
- DENALI NATIONAL PRESERVE BOUNDARY
- WILDERNESS AREA BOUNDARY
- PAVED ROAD
- UNPAVED ROAD
- PRIMITIVE ROAD
- RAILROAD

0 10 20 40 MILES

N

D E N A L I
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE [illegible]

Mount McKinley's visibility (and frequent invisibility) depends on the weather. Northerly winds commonly pile up clouds on the mountain's south flank, which then surround the entire peak. Because of its sheer immensity and height, the mountain mass tends to generate its own weather and cloud formation, even on days that may otherwise be clear. Many visitors to the area never get a glimpse of the mountain itself. A rough visibility index indicates that during the three summer months the peak is totally obscured about 30 days, visible 4 hours or less about 30 days, and visible more than 4 hours another 30 days. Some observers have claimed that visibility of the mountain is more reliable from the north than from the south, but this has not been substantiated.

Weather is also an important factor in other forms of visitor use. The peak visitor season is between June and mid September. Hiking may not be practical until early June, and snow may close the park road by mid September. Winters are extremely cold, particularly north of the Alaska Range, although snow depths rarely exceed 3 feet.

Greater snow depths and somewhat milder winter temperatures to the south of the range are more conducive to a broader range of winter visitor use. Spring provides the best opportunity for cross-country skiing, snowshoeing, and dogsledding. During the summer up to 18 hours of sunlight supply ample opportunity to enjoy the park, although mosquitoes (most abundant in June and July) are a constant annoyance. Early fall is one of the best seasons to visit Denali because there is a better chance of fair weather, the landscape is brilliant with color and the animals begin to show their winter coats.

Geology

The Alaska Range was formed through huge shifts in the earth over vast time periods. Geologically, the Denali area is one of the most interesting and important in North America. It encompasses a region of diverse igneous, metamorphic, and sedimentary rocks ranging from the Recent to the Precambrian period.

Clouds frequently obstruct the view of Mt. McKinley

Soils

Soil types within the area vary as a result of parent material, topography and vegetative cover. Permafrost (perennially frozen ground) is intermittently present throughout the lowlands north of the Alaska Range and is continuous at higher elevations both north and south of the range. Detailed studies of the extent of permafrost in lowland areas have not been made, but wells, road cuts, and other past development within the region have encountered permafrost at varying depths beneath the surface. Exact permafrost thicknesses have not been documented, but thicknesses of up to 100 feet have been recorded near the eastern entrance to the park. The presence of permafrost and widely distributed wet, boggy tundra makes construction of roads difficult and can result in the need for continuing repairs due to soil failures.

Vegetation

The five major vegetation associations within the park are low brush bog, bottomland spruce - poplar forest (taiga), upland spruce hardwood forest, moist tundra, and alpine tundra. The tree line within the park is at approximately 2,000 feet, except within protected river valleys where it may extend to 3,000 feet.

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Wildlife

The park hosts a wide variety and abundance of wildlife. Prominent large mammal species include moose, Dall sheep, grizzly bear, wolf and caribou. Within the park, these large mammals occur in greater concentrations north of the Alaska Range than south of the range. Other smaller mammal species are beaver, red fox, hoary marmot, coyote, collared pika, arctic ground squirrel, red squirrel, snowshoe hare, lynx, otter, porcupine, marten, wolverine, weasel, several kinds of mice, lemming, and vole.

Denali's bird life includes a variety of migratory waterfowl. Nonmigratory birds include chickadee, raven, magpie, woodpecker, ptarmigan, and owls. Trumpeter swans, formerly listed as endangered species, frequent floodplain meadows and small ponds.

Fish species include several types of salmon (king, coho, chum), arctic char, Dolly Varden, whitefish, burbot, northern pike, sheepfish, and grayling.

In general the wildlife on the south slopes of the Alaska Range is less visible than the wildlife along the park road corridor to the north. The existing park road follows a broad tundra valley north of the range and traces portions of a traditional caribou migration route. The dominant low mat vegetation and steep rock cliffs flanking segments of the route facilitate the viewing of large mammals (primarily caribou, Dall sheep, moose, and grizzly bear) at great distances.

EXISTING CONDITIONS

VISITATION

Visitation to the park has increased dramatically since the completion of the George Parks Highway in 1972, providing direct paved highway access from both Fairbanks and Anchorage. Since 1988, annual visitation at Denali has fluctuated around the 550,000 level. Recreational visit totals (estimated from traffic counts along the park road near the entrance) increased from 88,615 in 1972 to 592,431 in 1988, a growth rate of 31,500 recreational visits per year as shown in figure 1.

Use of Denali National Park and Preserve is highly seasonal, with the peak season beginning on Memorial Day and extending through the middle of September. In 1991, more than 98% of the recreation visits were made during the months of June through September. Only 9,200 of the 558,900 1991 visitors came to the park during off-season months.

Estimates of recreational visits are based on traffic counts and average vehicle occupancies near the park entrance. Because of the multiple trips to and from the park entrance by many visitors, these estimates overstate the number of visitors who actually gain access to the park's interior. In 1972, most visitor access by private vehicle was prohibited, and a mandatory bus system was developed. As a result, a truer measure of visitor use of the park can be made from ridership counts on the park's bus systems.

Since 1986, only visitors staying overnight at Teklanika campground, a limited number of visitors with travel permits, and those having access rights to travel to Kantishna have been allowed to use private vehicles on the park road beyond Savage River during the peak season. The Park Service operates a shuttle service, available free of charge to visitors who pay the $3.00 entry fee. Demand for the shuttles is high, and visitors typically wait one to two days during the peak season for a reserved seat. The park's concession operator, ARA Leisure Services, operates Denali wilderness tours and Denali natural history tours which are largely reserved for visitors travelling on package tours. The cash fare for the wilderness tour was $45.00 per person during the 1992 season. These visitor transportation systems are described in more detail later in this chapter.

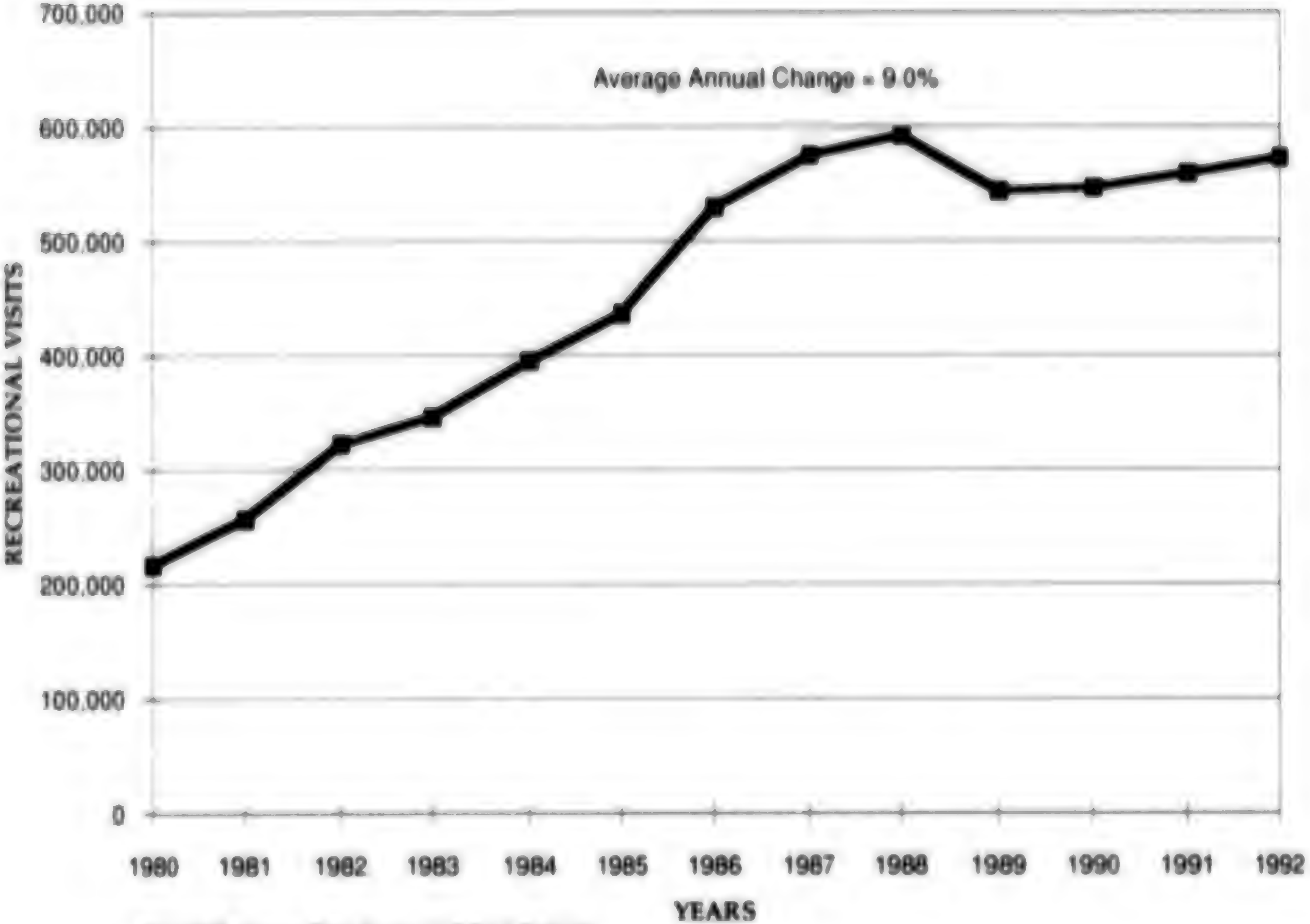
Over 95% of the visitors to the park interior use the bus systems.

Based on traffic counts at Savage River, more than 95% of visitors traveling into the park interior use the bus systems. Annual bus ridership reached 217,975 in 1992, about double the level of 1980, as shown in figure 2.

The greatest growth has been achieved by ARA tours, which increased ridership by an average of 11.9% per year to reach 117,656 riders in 1992. The NPS shuttle increased by 2.4% per year to reach 100,319 riders over the same period. The number of vehicle trips along the road is restricted to limit the impact of the road and traffic on wildlife. As a result, visitation at Denali is close to its effective capacity using the current bus transportation systems.

Figure 1: Denali National Park and Preserve

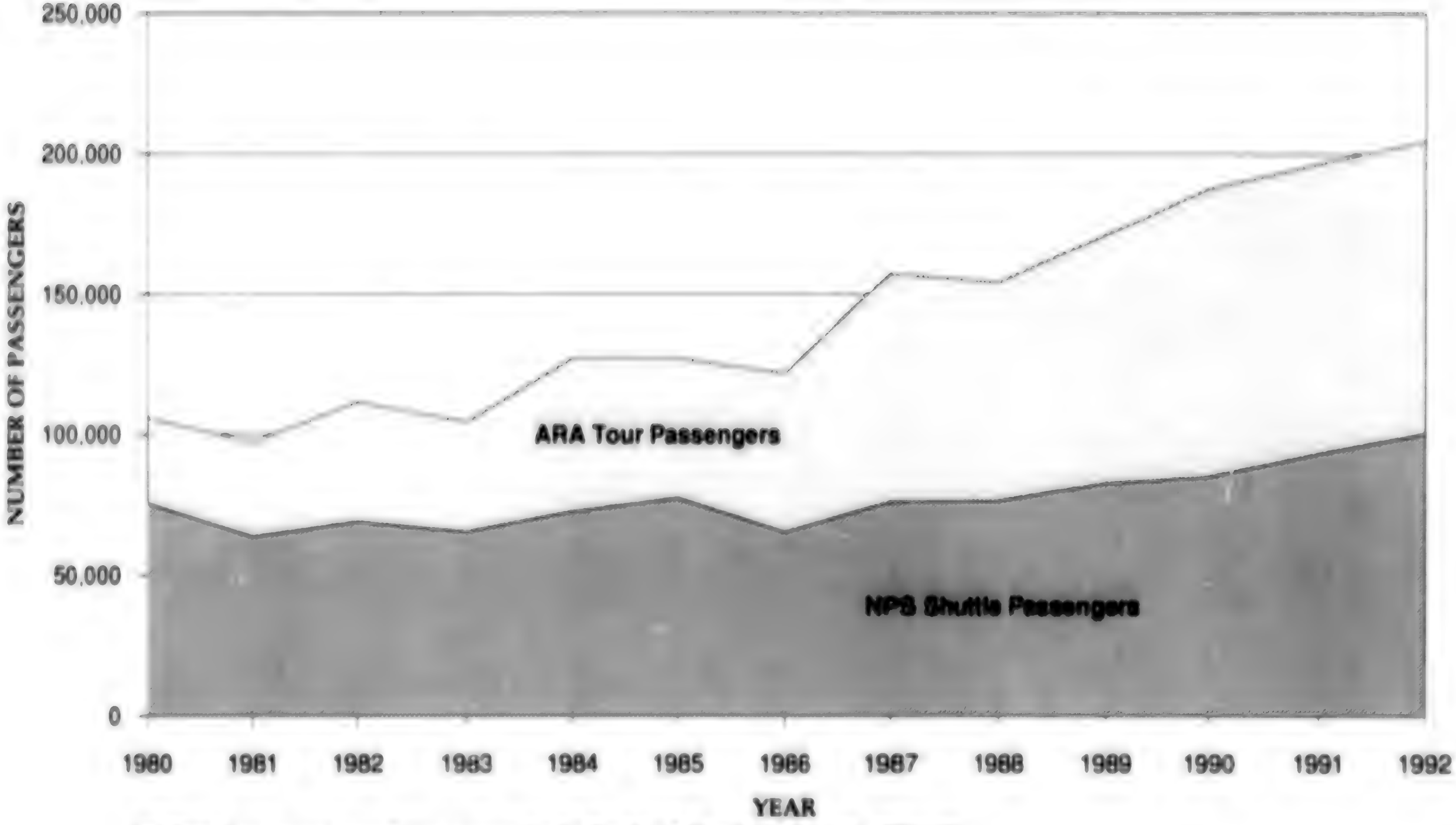
Recreational Visits



SOURCE: National Park Service statistical abstracts

Figure 2: Denali National Park and Preserve

Annual Shuttle and Tour Ridership Passing Primrose Ridge



SOURCE: Visitor statistic compilations prepared by the Denali staff, Denali staff data base, ARA staff
NOTE: Does not include ARA natural history tour

The use of VTS services is primarily concentrated over June, July, and August, with peak visitation occurring in July. Figure 3 shows the monthly distribution of passengers on concessioner and NPS buses into the park interior. Some opportunity to attract additional visitation to the park during June is evident from the monthly totals.

Because of its remote location, Denali does not have weekend visitation peaks or significant day-to-day variation in visitation levels. The flow of visitors is governed largely by the daily arrival of the Alaska Railroad and a relatively constant pattern of arrivals by private vehicle.

The Alaska Railroad carries many package tour visitors to Denali.

Denali is a significant attraction for Alaska tourism. Approximately 27% of peak season out-of-state visitors to Alaska make their way to the park. Figure 4 shows that this proportion has been declining over the last several years.

A significant factor in the growth of visitation has been the popularity of the Alaska National Railroad for travelling to Denali. In 1987, the railroad increased its service to add daily trips from both Anchorage and Fairbanks. As a result, the number of arrivals increased to more than 64,000. Visitors arrivals by train have continued to increase, reaching nearly 100,000 in 1991, as shown in figure 5. Most of the visitors arriving by train are package tour vacationers with reservations on one of the ARA tour buses. This partially accounts for the disproportionate growth in tour bus ridership over the past decade.

Estimates of overnight stays within Denali National Park are available by type of use from monthly use reports. RV camping and backcountry use have increased modestly over the last 10 years. This has been offset by a reduction in tent camping and hotel visitors as shown in table 2.

The decline in hotel overnight visitors is due to the closure of 23 units of the Denali Park Hotel in 1987. There is some additional capacity within the backcountry camping areas based on estimated average occupancy levels as shown in table 3.

The occupancy of recreational vehicle spaces is influenced by the management of the Teklanika campground. Visitors must purchase a three-day reservation for Teklanika, but many spend only one or two nights at the campground. This policy is intended to limit the private vehicle traffic on the park road generated by the Teklanika campground units.

VISITOR USE PATTERNS

Visitors to Denali National Park and Preserve fall into two distinct categories. About half of all visitors to the park are participants in package tours. Most of these tours include travel to other areas of Alaska. The other half of the visitors travel on their own to the park. The two groups experience the park in different ways.

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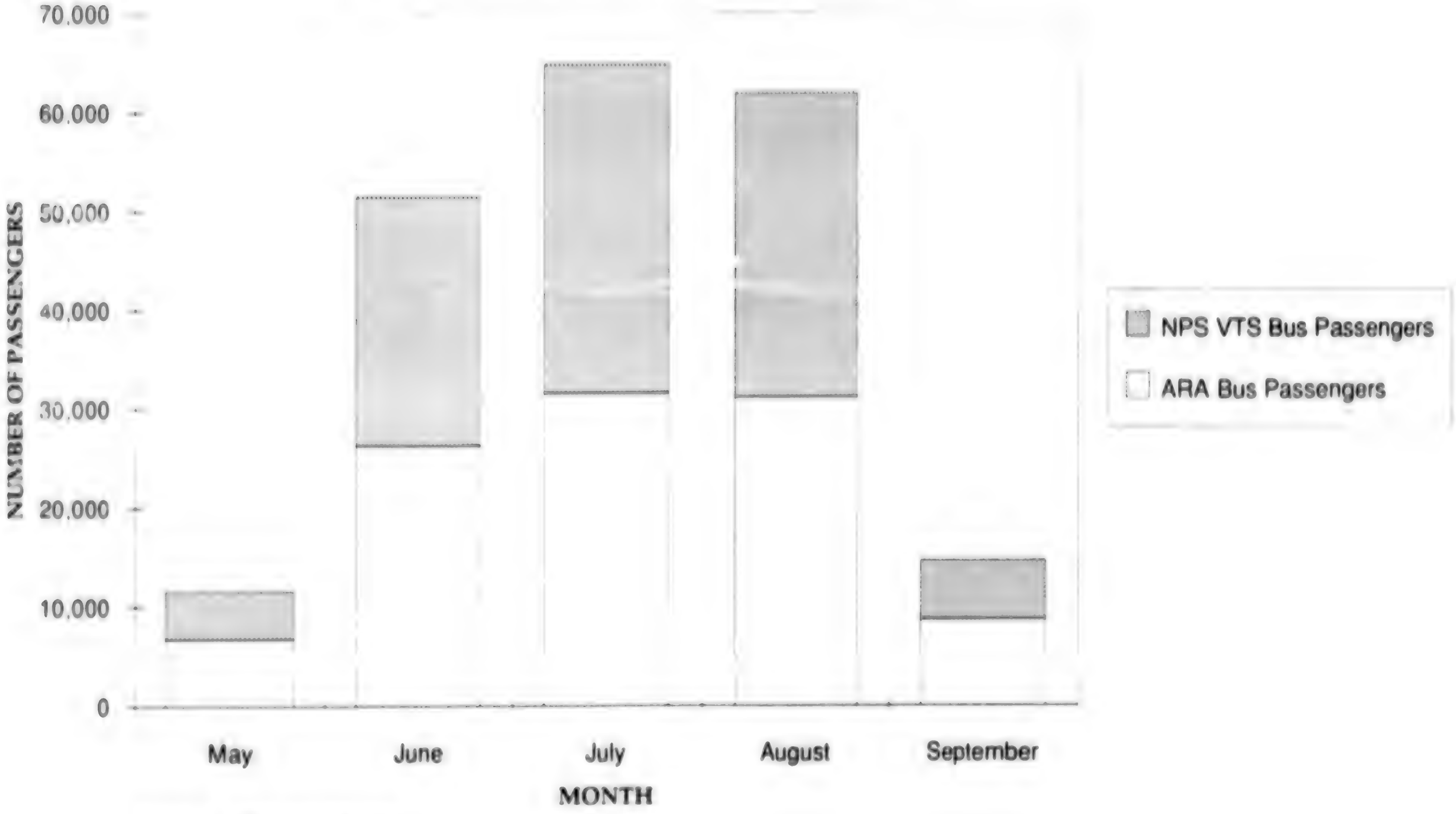
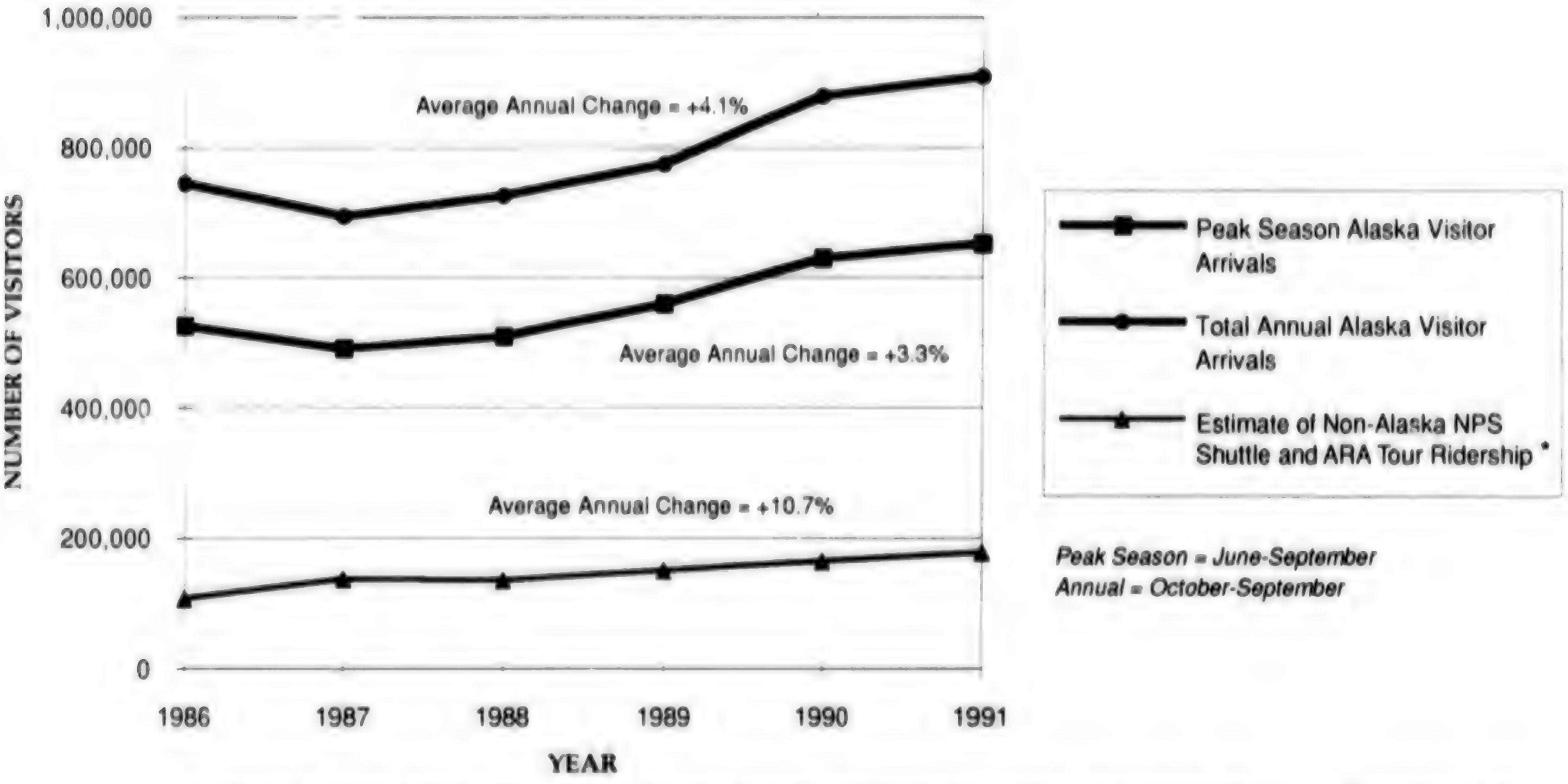
Figure 3: Denali National Park and Preserve
1992 NPS and ARA Bus Passengers by Month



SOURCE Denali staff data base

Figure 4: Denali National Park and Preserve

Alaska Non Resident Visitor Arrivals and Visitation



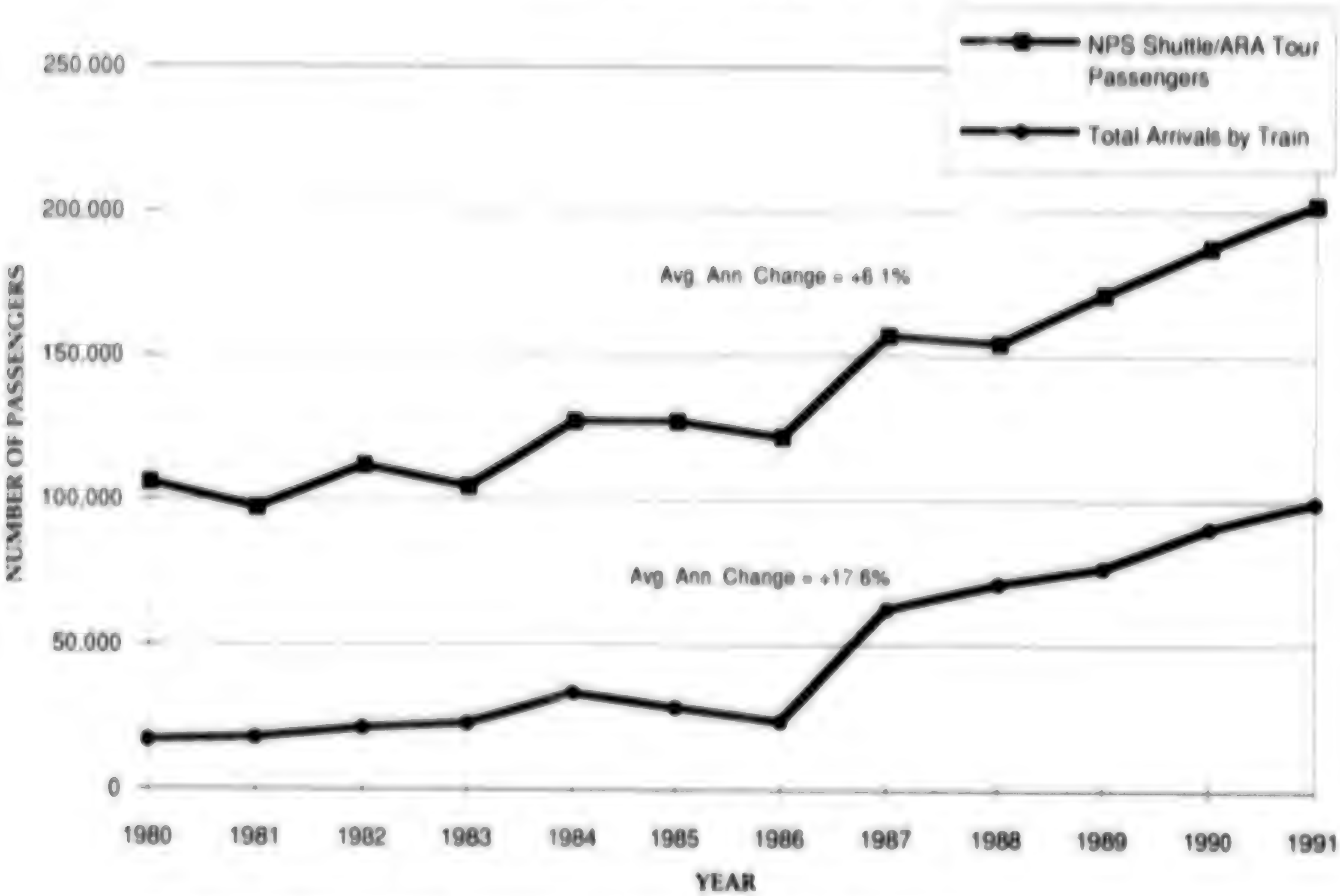
Peak Season = June-September
Annual = October-September

SOURCE Alaska Visitors Statistics Program II; Department of Commerce and Economic Development, state of Alaska 1991

* Actual Riders X .876

Figure 5: Denali National Park and Preserve

NPS Shuttle/ARA Tour Passengers vs.
Arrivals by Train



SOURCE: Visitor Statistic Compilations Prepared by Denali staff, National Park Service Statistical Abstract

Table 2: Overnight Stays in Denali National Park and Preserve

Year	Tents	RVs	Back-country[a]	Hotel	Total
1981	33,888	31,358	28,160	30,854	124,260
1982	37,117	28,131	27,812	30,994	124,054
1983	30,529	29,865	29,625	29,970	119,989
1984	34,194	35,923	26,722	29,150	125,989
1985	31,311	36,652	26,029	28,020	122,012
1986	33,523	33,548	27,999	29,752	124,822
1987	34,117	31,532	28,962	23,780	118,391
1988	35,669	41,831	29,460	22,101	129,061
1989	26,660	37,138	34,113	23,429	121,340
1990	25,348	30,981	35,918	24,459	116,706
1991	26,824	35,715	29,798	24,311	116,648
% Annual Change	-2.3%	1.3%	0.6%	-2.4%	-0.6%

Source: Denali park staff.

[a] Includes Mt. McKinley ascent groups.

Table 3: Estimated Utilization Rates of Park Overnight Facilities, 1991

Facility Type	# Units	Daily Average Occupancy	Peak Season Capacity[b]	Actual Occupancy	% Occupied
Hotel	103	2.25	25,724	24,311	95%
RV	192	2.5	53,280	35,715	61%
Tent	102	2.5	28,305	26,824	95%
Backcountry	200[c]	1.0	22,200	16,849[d]	76%

Source: BRW, Inc.

[b] 111 day season.
[c] Number of people allowed in backcountry units with maximum occupancy limits.
[d] Not including Mt. McKinley ascents (1992 data).

The itineraries of package tour visitors are closely managed to allow the Denali visit to fit into the overall tour schedule. These visitors almost exclusively use the ARA wilderness tour or natural history tour buses to gain access to the park's interior. They do not leave their buses, except at organized stops, and usually will not be exposed to any of the activities offered in the frontcountry portion of the park.

The ARA tour drivers provide an extensive narration on the park and its history, geology, habitat, and wildlife. Most package tour visitors stay at lodging outside the park boundary, and their stay at the park is limited to one night. Many of these visitors have no contact with NPS rangers, interpretive staff, or other personnel.

The second group of visitors have a much more diverse range of experiences available to them. However, they are provided with much less organizational assistance with the logistics of staying at and travelling in the park. The experience of these visitors depends on the system of shuttle buses providing access to the park interior. Many visitors may not be aware of the shuttle service operation and reservation procedures when they arrive at the park. For the majority, pre-arranged reservations are not available, resulting in a high degree of uncertainty about the duration of their visit and the sequence of events. Because the shuttle system is operating near its capacity and because demand for overnight accommodations far exceeds the available supply within the park and in the surrounding area, many visitors spend a significant amount of time waiting to gain access to the primary attractions in the park.

The visitor access center provides reservations and orientation for visitors.

A typical visitor arriving at mid-day during the peak visitation period follows the signs to the visitor access center (VAC) and finds the parking lot nearly or totally full. After finding a parking place, the visitor enters the center and discovers that the available camping spots are occupied and that all shuttle bus trips for the remainder of that day and the next are full. The NPS staff may suggest that the visitor return early the following morning to secure a spot on a bus on the next day.

The visitor is now faced with finding overnight accommodations outside the park, which are also likely to be full. As a result, informal camping spots have developed at turnouts along the George Parks Highway outside the park. Up to 200 vehicles can be observed on a typical summer night in these locations.

Visitors faced with a one- to two-day wait for a shuttle ride have some opportunities for recreation and interpretation in the park. Demonstrations of dog sled teams and interpretive talks are provided near park headquarters. Several trails provide hiking access to points within the frontcountry. Many visitors choose to drive up the park road to Savage River. Wildlife viewing opportunities exist along this stretch of road, as does a view of Mt. McKinley.

Visitors may have trouble finding parking. Overnight accommodations are generally full.

Several recreation opportunities have been created outside the park, including flightseeing tours into Denali and river rafting operations. These activities, provided by private entrepreneurs, allow visitors to pass the time as they await their reserved bus trip into the park. However, many visitors, having traveled long distances to reach Denali, are not able to adjust their travel plans to accommodate the necessary wait. These visitors probably leave the park quite disappointed. Approximately 15% of the passengers with reserved bus seats do not show up for their trip, and another one in 20 leave the visitor access center without reserving a seat. This implies that up to one in five visitors wanting to get onto a shuttle bus are not successful during high use periods.

Visitors wait up to two days for shuttle rides to the park interior.

The current approach to allocating available shuttle bus seats and the high level of demand combine to increase the demand for overnight accommodations. An average of 4,550 visitors are spending the night in or near Denali on a given summer day; each stays about 2.3 days in the park. Park management is committed to providing an advance reservation system similar to that used for camping spaces at Yosemite National Park. A reservation system of this type would help to reduce the demand for overnight accommodations, should allow visitors to better plan their time around their trip into the park, and could reduce the number of visitors who come to the park and are not able to gain access to the park interior.

VISITOR CHARACTERISTICS

The characteristics of visitors and visitor groups have been summarized from a survey conducted in the park in 1989 by the University of Idaho. The survey yielded responses from 428 visitor groups. One individual per group responded for each group.

Origin

According to the visitor survey, approximately 13% of Denali visitors were from Alaska, 76% from elsewhere in the United States and 11% from foreign countries. The greatest proportion of foreign visitors were from Germany, Canada, Switzerland, and Japan. Based on survey responses, the greatest number of US visitors from the lower 48 states came from the most populous states, reflecting the importance of Denali as a national rather than regional destination.

Age

As with many of the western national parks, Denali is a popular destination for retirees. Forty seven percent of the survey respondents were over 55 years of age. The average age of the survey sample was 50.7 years.

Type of Group

Most visitors came with family and friends. Such groups accounted for 70% of visitor groups. Tours accounted for 21% of the groups surveyed but would account for a considerably higher proportion of all visitors given the larger average size of tour groups.

Length of Stay

Of all visitor groups, 90% stayed overnight in the Denali area, and 76% of the overnight visitors stayed one or two nights.

Table 4: Denali Area Accommodations

Accommodation Type	# in park	# outside park	# at Kantishna	Total
Hotel rooms	103	853	87	1043
Tent camping only	102	0	0	102
RV and Tent Camping	192	375	0	367
Backcountry Permits[a]	200	0	0	200
Total Accommodations	597	1228	87	1912

Source: Denali National Park and BRW, Inc.

[a] Units with use limits. Maximum number of people allowed.

Mode of Travel

Denali is possibly unique in the national park system in its level of dependence on public transportation modes. Only 45% of visitor groups arrived by private vehicle and 15% by rental car which, would leave 40% of the groups arriving by bus, train, or plane. The train accounted for 23% of group travel which, although not specifically reported, would mean that buses account for most of the remaining 17%. More than 50% of visitors arrive by public transportation.

VISITOR FACILITIES

Currently, all visitor facilities are confined to the 88.5-mile park road corridor within the park and the portion of George Parks Highway near the park entrance. Visitor access to these facilities by private vehicle is restricted at Savage River. Beyond this point on the park road, most visitors travel on one of the two bus services that operate in the park. Total accommodations in and near the park equal 1,912 units as shown in table 4.

The National Park Service operates seven campgrounds in the park with a total of 294 campsites. Other overnight accommodations in the park include the Denali National Park Hotel near the entrance to the park with 103 rooms. There are also four privately operated lodges on private land in Kantishna at the end of the park road. Accommodations within the park total 597 units.

Outside the park there are a number of commercial operations near the park entrance that provide an additional 853 lodging units and 375 campsites.

An additional 200 informal camping spots are scattered in turnouts along the George Parks Highway north of the park entrance. These spots are fully occupied on many summer nights.

Based on an average occupancy of 2.25 persons per lodging unit and 3 persons per camp site, daily average peak season occupancy in the Denali area is about 4,550 persons.

The major visitor facilities within the park are described below. The maps, which follow the descriptions, show front country visitor facilities and an overview of the park road corridor.

Riley Creek Campground and Long-Term Parking Area

The Riley Creek Campground, located at milepost 0.4 on the park road, has 102 campsites for tents, trailers, and RVs. The Riley Creek area is served by the NPS circulator shuttle or loop bus, which takes visitors to the visitor activity center, Denali Hotel, and to the Alaska Railroad train depot. Also at Riley Creek is a large long term parking lot with approximately 156 parking spaces. The lot is primarily used by overnight campers but also serves as an overflow lot for the visitor activity center.

Visitor Access Center (VAC)

The center (milepost 0.7) provides visitors with park information and reservations, including shuttles, campgrounds, backcountry camping, hiking, and interpretive programs. Visitors are directed by signs to the center as soon as they enter the park. There is also a book store in the facility. The center also serves as the staging area for the VTS shuttles to the park interior. The VAC parking lot has spaces for 130 cars and 144 RVs.

The Denali Park Hotel

The Denali Park Hotel (milepost 1.5) has 103 rooms and support retail service facilities. The hotel also contains the ARA tour bus office and serves as the terminal for the ARA wilderness and natural history tours. Behind the hotel, ARA maintains a bus parking yard and maintenance base. An auditorium with 350 seats is also behind the hotel. Parking is provided for hotel guests and employees. Many of the guests arrive by train, so the parking is generally not fully occupied.

Alaska Railroad Depot and Airstrip

Daily trains from Anchorage and Fairbanks arrive at the Alaska Train Depot (milepost 1.6). The depot, built in 1989, also contains a small gift shop, concessions area, restrooms, and waiting area. The depot also acts as a staging area for area hotels, which provide private courtesy shuttle services to and from the park. The Denali park airstrip is adjacent to the depot. The unpaved airstrip is used by Denali Wilderness Air, which provides sightseeing flights into the park.

The Denali Park Hotel is the starting point for ARA tours.

Morino Backpackers Campground

The Morino campground (milepost 1.7) is available only to visitors on foot and has a limit of 60 people. This small campground provides a water supply and chemical toilet facilities.

Denali National Park Headquarters

At the 3.4 milepost, this area accommodates administrative functions and also contains the sled-dog kennels, which is becoming a popular attraction for park visitors. Special shuttle buses circulate through this area on a separate loop road connecting to the main park road. The shuttle bus riders leave the shuttle and walk through the facility to observe a dog-sled training demonstration.

Savage River Campground

The Savage River campground (milepost 12.8) has 34 sites for tents, trailers and campers, plus six sites for larger groups. It is the last campground on the paved road accessible by private vehicle without a special permit.

Savage River Bridge and Check Station

The Savage River bridge (milepost 14.8) is the furthest point for private vehicle access and also

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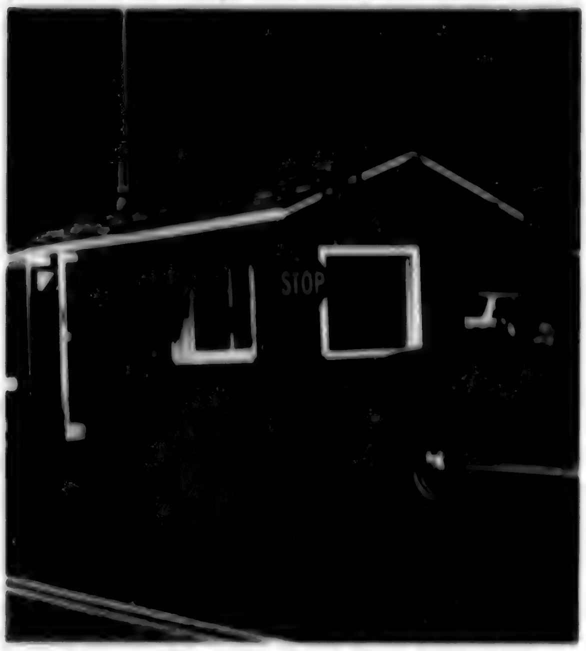
the end of the paved road. On each end of the bridge, gravel parking areas are provided for visitors who may want to park and hike or bike further into the park. The parking areas have picnic tables and portable bathroom facilities.



Traffic is restricted beyond the Savage River check station.

Crest of Primrose Ridge

This area (milepost 17.3) provides a road pulloff that is used as a turnaround area for the private concessioner's natural history tours. The area provides the last view of Mt. McKinley for the next 20 miles. This pulloff is not used by any of the other buses.

Sanctuary Campground

The Sanctuary campground (milepost 22.7) has seven sites which are available for tents only. This facility also contains a ranger cabin, which is visited frequently in the winter months by dog sleds.

Teklanika Campground

Just before the Teklanika River (milepost 29.1) is the second largest campground in the park. The facility has 50 sites for RVs and tents. This area is reserved for visitors with special permits that allow them to bring private vehicles into the park interior. The permits are sold in three-day units, limiting the average daily traffic generation to one third of the campground's capacity. Beyond Teklanika, only NPS shuttles, wilderness tours, NPS vehicles, and cars with a permit are allowed.

Teklanika Rest Stop

The Teklanika Rest Stop (milepost 30.3) is used by both the NPS shuttles and the private concession tours. The buses stop here for approximately 15 minutes. The drivers allow all passengers to use the portable restroom facilities and observe the interpretive exhibit that overlooks the Teklanika River.

Teklanika rest area has primitive facilities.

Igloo Creek Campground

Igloo Creek (milepost 31.4) is a primitive campground with seven campsites for tents only. A ranger station here is used by dog sled park patrols in the winter.

Polychrome Pass Rest Stop

The Polychrome Pass Rest Stop (milepost 45.9) is at the summit of Polychrome Pass. The area provides a spectacular view of the Alaska Range, painting a perfect picture of Alaska's scenic beauty. Built in 1991, the facility includes restrooms and an expansive viewing deck and shelter. Above the restroom facility is a short interpretive nature trail that can be enjoyed while the buses stop for 10 to 15 minutes. The stop has adequate parking for about 5 buses.

The Polychrome Pass rest area was built in 1991.

Toklat Bridge Rest Area

The Toklat Rest Area (milepost 53.1) is adjacent to the braided, glacial stream bed of the Toklat River. This area is very exposed but provides visitors with a vast view of the surrounding territory. Dall sheep can frequently be seen on the surrounding hillsides. The location provides enough space to allow NPS shuttles and ARA wilderness tours to park simultaneously. Up to 10 buses can park here at one time. Picnic and portable restroom facilities are well used. The wilderness tours use this area as a turnaround area if Mt. McKinley is under the clouds. Otherwise, they will continue to the Stony Hill overlook.

Stony Hill Overlook

The Stony Hill overlook (milepost 62.0) is an excellent viewing point for Mt. McKinley. When the mountain is visible, this overlook is used as the turnaround and picnic point for the ARA wilderness tours. NPS shuttles do not use this stop.

The Toklat River rest stop can be crowded on cloudy days.

Eielson Visitor Center

Eielson Visitor Center (milepost 66.0) is in an area that provides a breathtaking view of Mt. McKinley and the Muldrow Glacier. There is an abundance of wildlife in the area and hiking is a popular activity when the weather is good. Eielson is the final destination for most VTS buses. Eielson has full visitor facilities including a book store, restrooms, interpretive exhibits, information desk, and outdoor picnic areas. Members of the park staff also provide narrated nature hikes from this location. The facility has a large parking area that is used by the shuttles and park employee vehicles. Maximum occupancy is approximately 10 shuttle buses and 6 automobiles. During periods of poor weather, the visitor center building can become crowded because there is no other area that provides protection from wind and rain.

Wonder Lake Rest Stop and Campground

The Wonder Lake Campground (milepost 86.1) has 28 tent sites and a restroom facility. This is the closest point to Mt. McKinley along the park road. Occasionally, expedition parties will hike to the base of the mountain from this point. A

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ranger station serves the surrounding area. This is the terminal point for the visitor shuttle system. Approximately 20% of shuttle passengers make the 11-hour round-trip to Wonder Lake.

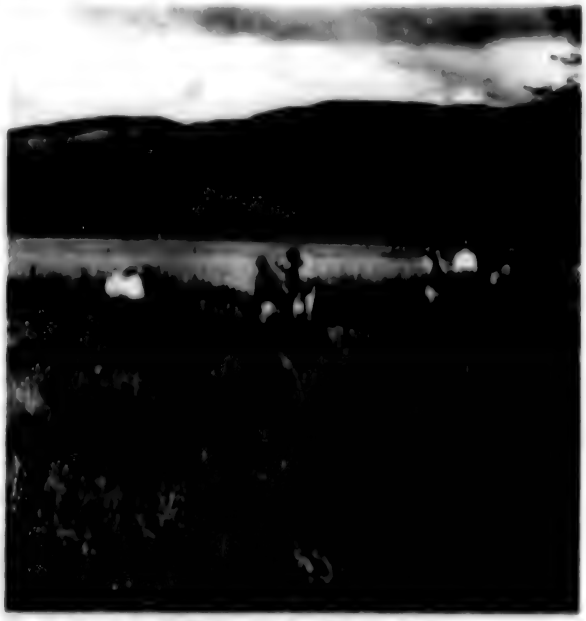
Most VTS riders travel to Eielson Visitor Center.

The park road continues past Wonder Lake to a ranger station at the Denali Wilderness boundary and then to the small mining community of Kantishna at 92 miles on the park road. Kantishna is comprised of private in-holdings on historic mining claims. No mining activity has occurred in recent years. Four lodging facilities with a total of 87 units provide up to 150 guests with vacation accommodations. The lodge operators provide shuttles which carry passengers from the park entrance to Kantishna.

Access to the mining claims and lodging facilities in Kantishna has been the source of much concern. The Alaska National Interest Land Conservation Act mandates that the park provide "adequate and feasible access for economic and other purposes" for activities on privately held lands within the park. The prospect of expanded development in Kantishna threatens the current balance between visitor access and enjoyment and preservation of the wilderness qualities and outstanding wildlife resources of the park.

TRANSPORTATION FACILITIES

Denali National Park and Preserve is unique in many respects. Among the most striking aspects of the park are the unique transportation facilities that provide access to the park and provide for visitor movement within the park.



The final stop for VTS shuttles is at Wonder Lake.

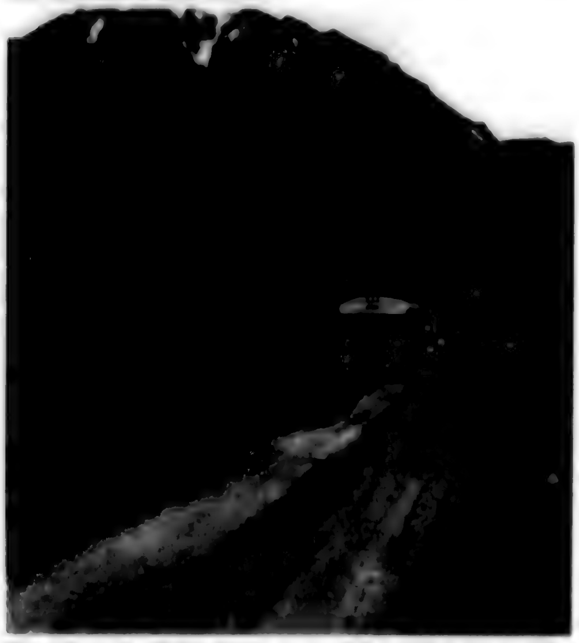
Access to Denali National Park and Preserve

Most visitors traveling to Denali use either the George Parks Highway or the Alaska Railroad. Both connect Anchorage and Fairbanks along an approximately 360-mile route. Travel time via the highway is about four hours from Anchorage and two hours from Fairbanks. One train runs in each direction daily during summer months. Trains are made up of several regular passenger cars and several special cars that are provided by tour companies for the exclusive use of travelers on package tours. Individual access in private or rental vehicles via the George Parks Highway and group access via train account for most Denali visitors.

The George Parks Highway is a paved two-lane road built to high speed standards. In July it carries approximately 2,500 cars per day near the park entrance, as shown on the accompanying map. The Denali Highway (Alaska Highway 8) provides a route to the

Richardson Highway to the east. Before the George Parks Highway was completed in 1972, the Denali Highway provided the only road access to the park.

Access to all visitor facilities and resources within the park, except for climbing support for most Mt. McKinley ascents, is provided by the park road. The Alaska Railroad depot and the Denali airstrip are on the park road across from the Denali Park Hotel.



The park road and bus service are crucial to visitor access and resource preservation.

The Denali Park Road

Transportation facilities in the park consist of a series of access drives and parking areas organized around the park road. The accompanying maps illustrate the facilities located in the front country and along the park road corridor. Denali is uncommon among parks in that vehicle access is provided by a single road, which is gravel-surfaced for most of its length. In retaining a wilderness character along most portions of roadway, many steep and narrow segments do not provide safe travel conditions for private vehicles.

The dual functions of access and resource protection are served by the combination of the park road and the mandatory visitor transportation systems that operate along it. The association between the road and the transit service is significant in meeting the management goals of the park. Without either element, it would not be possible for visitors to experience the singular habitat, wildlife and scenery Denali has to offer. Although several class III (special purpose roads providing access to public use areas) and administrative roads connect to the park road along its length, this discussion is limited to the park road itself.

The first 15 miles of the park road are paved and open to all visitor traffic. The road is designated as class I from the park entrance to Savage River checkstation at milepost 14.9. Class I roads constitute the main access routes, tour routes, or thoroughfares for park visitors. Beyond Savage River, the road is designated as class II, defined as roads that provide access within a park to areas of scenic, scientific, recreational, or cultural interest.

The park road is within a 300-foot corridor which is excluded from the wilderness designation applied to the area of the park beyond the headquarters. The wilderness exclusion widens at visitor facilities along the park road and generally extends to 150 feet beyond the limits of the developed area of these facilities. Transportation improvements which would extend beyond the boundary of the wilderness exclusion would require a change in the wilderness boundary definition.

The section of the park road leading to the Savage River bridge was originally paved in the 1960s and was rehabilitated in 1990. It is a consistent 26-foot width, consisting of two 11-foot paved travel lanes and 2-foot gravel shoulders. The posted speed limit is 35 miles per hour. Nearly all traffic entering the park travels the first 1.8 miles of the road to the Denali Park Hotel.

The traffic along this section of road includes long-distance tour and charter buses, complimentary shuttles between the hotel and lodging facilities outside the park, NPS shuttles, concessioner wilderness tour and natural history

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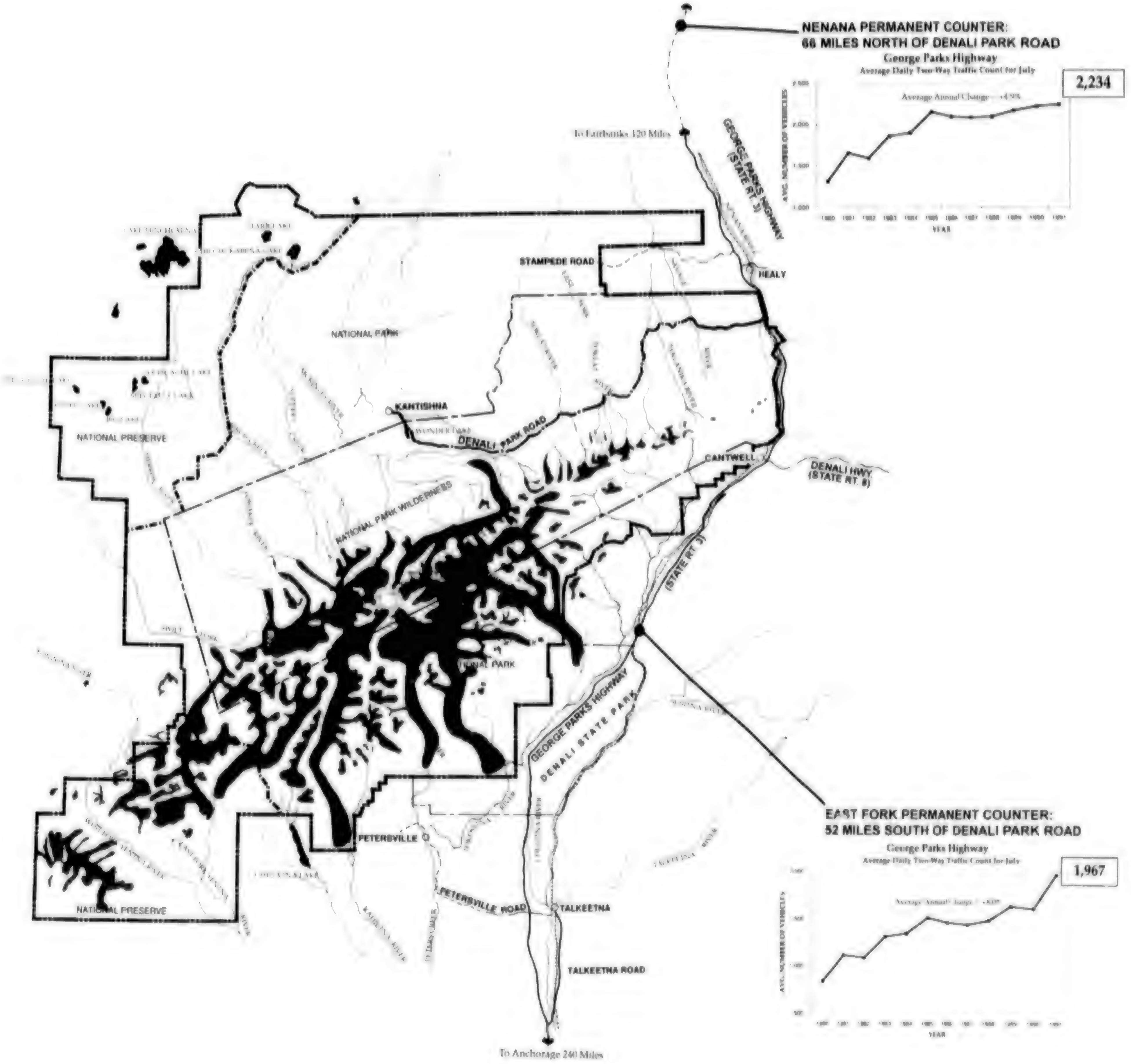
GEORGE PARKS HIGHWAY TRAFFIC COUNTS



D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC APRIL 94 184 20266B

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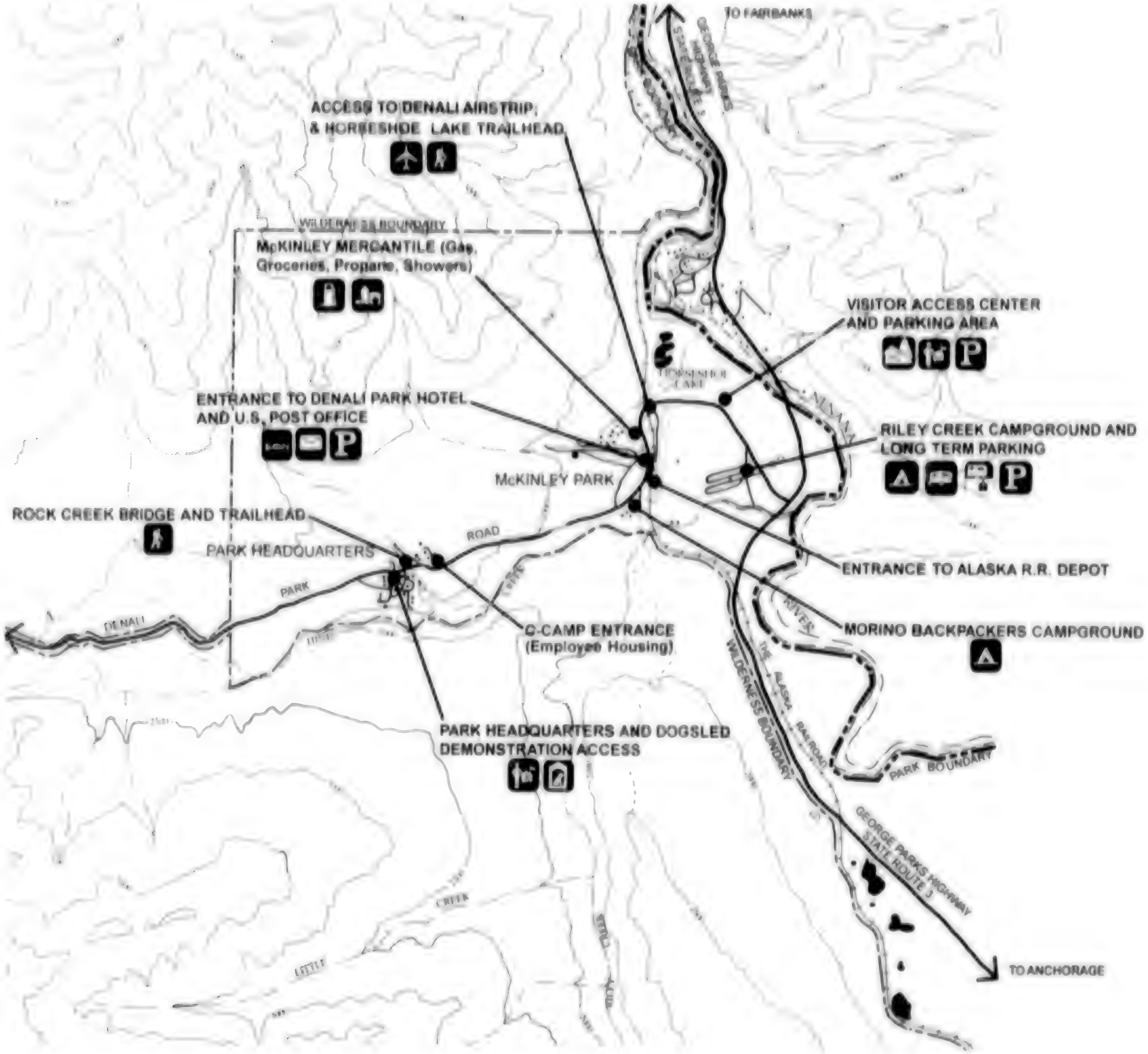
FRONTCOUNTRY KEY FACILITIES


TO FAIRBANKS
GEORGE PARKS HIGHWAY STATE ROUTE 3
ACCESS TO DENALI AIRSTRIP; & HORSESHOE LAKE TRAILHEAD
WILDERNESS BOUNDARY
McKINLEY MERCANTILE (Gas, Groceries, Propane, Showers)
VISITOR ACCESS CENTER AND PARKING AREA
HORSESHOE LAKE
ENTRANCE TO DENALI PARK HOTEL AND U.S. POST OFFICE
RILEY CREEK CAMPGROUND AND LONG TERM PARKING
McKINLEY PARK
ROCK CREEK BRIDGE AND TRAILHEAD
PARK HEADQUARTERS
ROAD
PARK
DENALI
ENTRANCE TO ALASKA R.R. DEPOT
C-CAMP ENTRANCE (Employee Housing)
MORINO BACKPACKERS CAMPGROUND
RIVER
WILDERNESS BOUNDARY
THE ALASKA RAILROAD
PARK HEADQUARTERS AND DOGSLED DEMONSTRATION ACCESS
PARK BOUNDARY
GEORGE PARKS HIGHWAY STATE ROUTE 3
CREEK
LITTLE
TO ANCHORAGE

LEGEND:

- GAS STATION
- TRAILER SITES
- TRAILER DUMP STATION
- HOTEL
- TRAILHEAD
- GROCERY STORE
- VISITOR CENTER
- CAMPGROUND
- RANGER STATION
- AIRSTRIP
- U.S. POST OFFICE
- KENNEL
- PARKING

0 1 5 10 MILES

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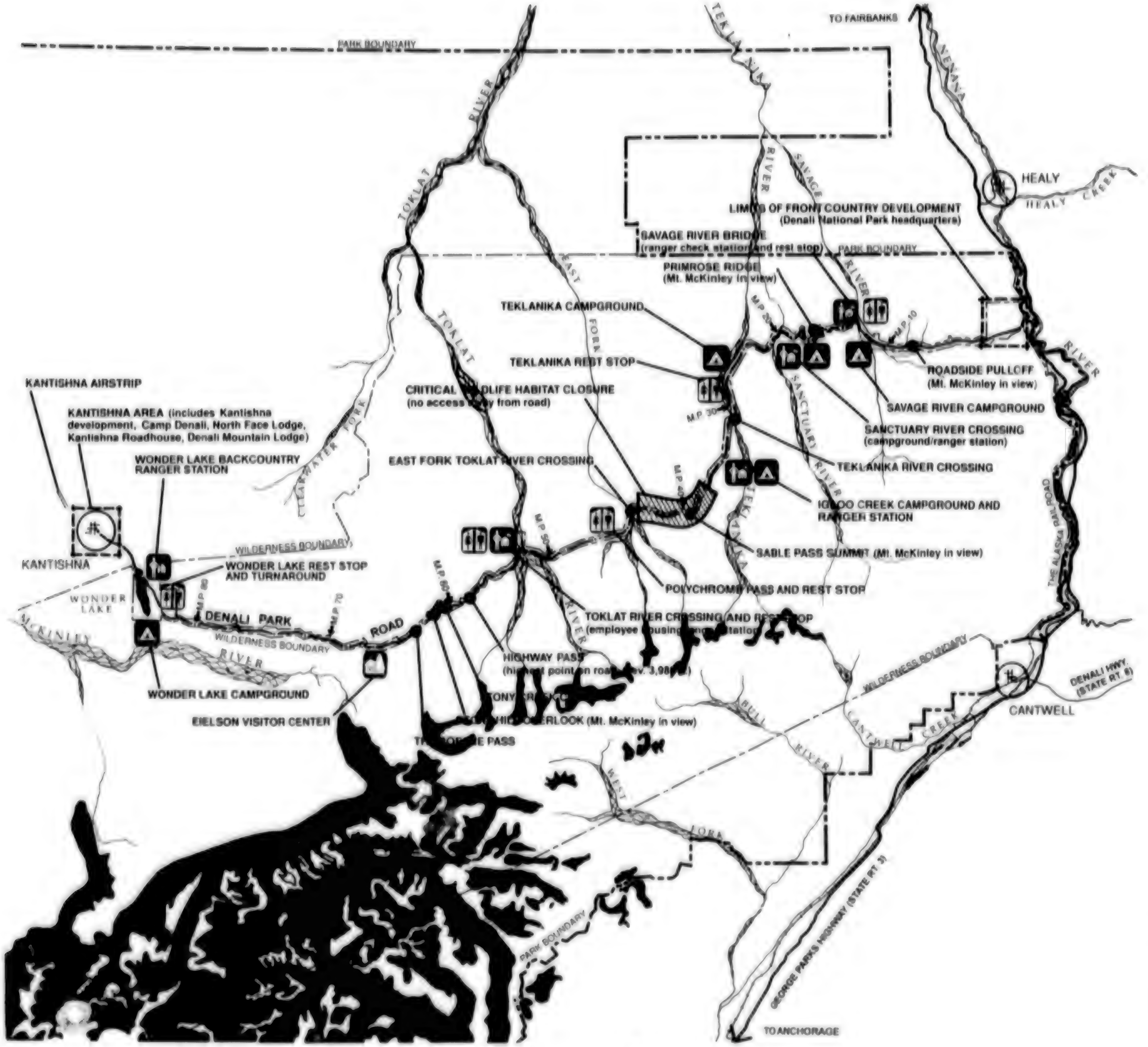
DENALI

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE [illegible]


TO FAIRBANKS
PARK BOUNDARY
TOKLAT RIVER
TEKLANIKA
NENANA
HEALY
HEALY CREEK
LIMITS OF FRONT COUNTRY DEVELOPMENT
(Denali National Park headquarters)
SAVAGE RIVER BRIDGE
(ranger check station and rest stop)
PARK BOUNDARY
PRIMROSE RIDGE
(Mt. McKinley in view)
RIVER
SAVAGE
M.P. 20
M.P. 10
TEKLANIKA CAMPGROUND
EAST FORK
TOKLAT
TEKLANIKA REST STOP
RIVER
ROADSIDE PULLOFF
(Mt. McKinley in view)
SAVAGE RIVER CAMPGROUND
KANTISHNA AIRSTRIP
CRITICAL WILDLIFE HABITAT CLOSURE
(no access away from road)
M.P. 30
SANCTUARY RIVER CROSSING
(campground/ranger station)
KANTISHNA AREA (includes Kantishna development, Camp Denali, North Face Lodge, Kantishna Roadhouse, Denali Mountain Lodge)
CLEARWATER FORK
WONDER LAKE BACKCOUNTRY RANGER STATION
EAST FORK TOKLAT RIVER CROSSING
SANCTUARY RIVER
TEKLANIKA RIVER CROSSING
M.P. 40
IGLOO CREEK CAMPGROUND AND RANGER STATION
THE ALASKA RAILROAD
WILDERNESS BOUNDARY
M.P. 50
SABLE PASS SUMMIT (Mt. McKinley in view)
KANTISHNA
WONDER LAKE REST STOP AND TURNAROUND
TEKLANIKA
WONDER LAKE
M.P. 80
M.P. 60
POLYCHROME PASS AND REST STOP
DENALI PARK
M.P. 70
ROAD
TOKLAT RIVER CROSSING AND REST STOP
(employee housing/ranger station)
McKINLEY
WILDERNESS BOUNDARY
RIVER
HIGHWAY PASS
(highest point on road elev. 3,980 ft.)
WILDERNESS BOUNDARY
DENALI HWY. (STATE RT. 8)
WONDER LAKE CAMPGROUND
STONY CREEK
CANTWELL
EIELSON VISITOR CENTER
STONY HILL OVERLOOK (Mt. McKinley in view)
BULL RIVER
CANTWELL CREEK
THOROFARE PASS
WEST FORK
PARK BOUNDARY
GEORGE PARKS HIGHWAY (STATE RT. 3)
TO ANCHORAGE

DENALI ROAD CORRIDOR

LEGEND:

🚻	REST STOP
⛺	VISITOR CENTER
▲	CAMPGROUND
👤	RANGER STATION
●	POINT OF INTEREST
⬚	AREA OF DEVELOPMENT
←M.P.	MILEPOST MARKER

0 1 5 10 MILES

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D E N A L I
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC-APRIL [illegible]

tour buses, service vehicles, and visitor traffic in private vehicles. A significant amount of circulation occurs between in-park facilities along this portion of the road and lodging and camping facilities outside the park. Daily traffic volumes during the 1987 season averaged 2,500 and reached a monthly average peak of 3,422 over this segment of the park road.

The first 15 miles of the park road are paved.

Between the hotel and Savage River Campground, traffic volumes decline markedly. The peak monthly average daily traffic on this portion of the paved section of road was 735 vehicles in 1987.

Two miles beyond Savage River Campground is the Savage River bridge and check station. Private vehicular traffic is restricted beyond this point. The road's surface is gravel or dirt for the remainder of its length. From the Savage River to the Teklanika River at milepost 31.3, the road was reconstructed in the early 1960's. The width of this section varies from 28 to 38 feet, and its alignment is consistent with the posted 35 mile per hour speed limit. The gravel surface of this section of the road generates substantial amounts of dust in dry weather.

Beyond the Teklanika River, the road remains very much like it was when first completed in the 1930's. Minor realignments, maintenance improvements, and repairs have been accomplished over the years, and each of the major river crossings has been upgraded. The road is mostly 20 to 25 feet in width from Teklanika to the Eielson Visitor Center, except for segments crossing rugged, mountainous terrain at Sable and Polychrome passes.

Between the Savage and Teklanika rivers, the park road has been reconstructed.

In these two areas, the road width varies from 15 to 20 feet. Especially on Polychrome Pass, steep side slopes, unstable soil conditions, and intermittent seismic activity lead to frequent rock falls and slides and a need for extensive maintenance. In these sections, roadway widening would require extensive cuts and retaining walls, resulting in a significant change in the character of the road.

Beyond the Eielson Visitor Center at milepost 66.0, the road width varies between 15 and 20 feet and in most areas the road has a dirt surface. In the rugged Eielson Bluffs area, the road character varies suddenly from a one-lane track to two-lane operation. About one in five NPS shuttles buses travels beyond the Eielson Visitor Center; none of the concessioner tour buses go beyond Stony Hill, about 3 miles east of Eielson Visitor Center.

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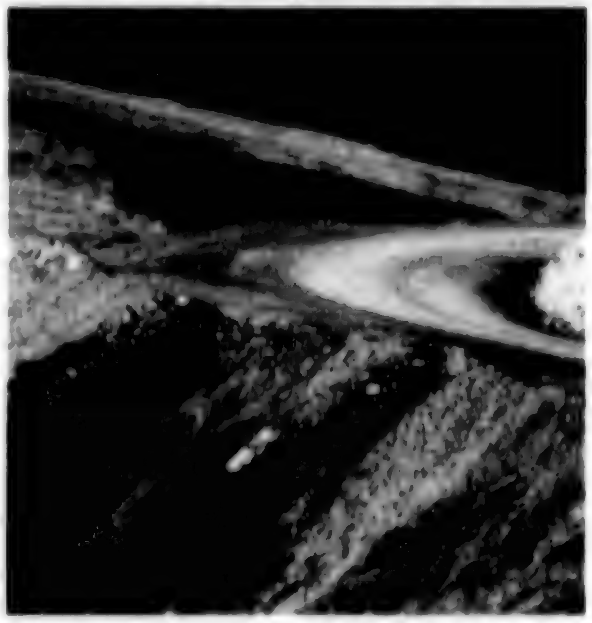
The gravel road surface between the Savage and Teklanika river bridges is generally in good condition. Some portions of this road segment have road foundation problems, but for the most part, the reconstruction in the 1960s has held up reasonably well.

Between Teklanika and the Eielson Visitor Center, the road surface is a mixture of graded gravel and native soil. The surface is intermittently rough and potholed. Foundation, drainage, and surface problems occur along the road, because of saturated soils, poor drainage ditches, washouts (particularly at culverts), and isolated landslides.

Ongoing maintenance is vital to the continued operation of the road. Maintenance activity is carefully managed to limit the migration of road gravel beyond the road edges and to conserve gravel. Gravel supplies are highly problematic, due to the high cost and limited availability of gravel outside the park boundary and NPS management policies that direct park managers to use sources inside the park *only when economic factors make it totally impractical to import materials...*[1]

At present, an 18-person staff is continually working on the road throughout the summer. In May, the crews focus on clearing snow and making repairs necessary to open the road to bus traffic. In the fall, major maintenance and repair activities are scheduled, but the completion of the work can be hampered by early snows. This was the case in 1992, when a 3-foot snowfall occurred on September 11. Throughout the summer, minor grading, drainage maintenance, and response to road failures and slides keep the maintenance crews busy. Annual expenditures on road maintenance total $500,000.

NPS, concessioner, and private Kantishna shuttles have travelled the park road since 1972 with few serious accidents. A 1981 accident at Thoroughfare Pass involving a concessioner tour bus resulted in five fatalities and 28 injuries when a bus left the road as it pulled away from a stop to view a group of caribou. No serious accidents have occurred on Sable or Polychrome passes. The excellent safety record on the road, despite the presence of narrow, steep, and winding road sections, is primarily attributable to the restriction of traffic to buses whose operators are intimately familiar with the road, weather conditions, and the special demands that driving on such a road places on drivers.

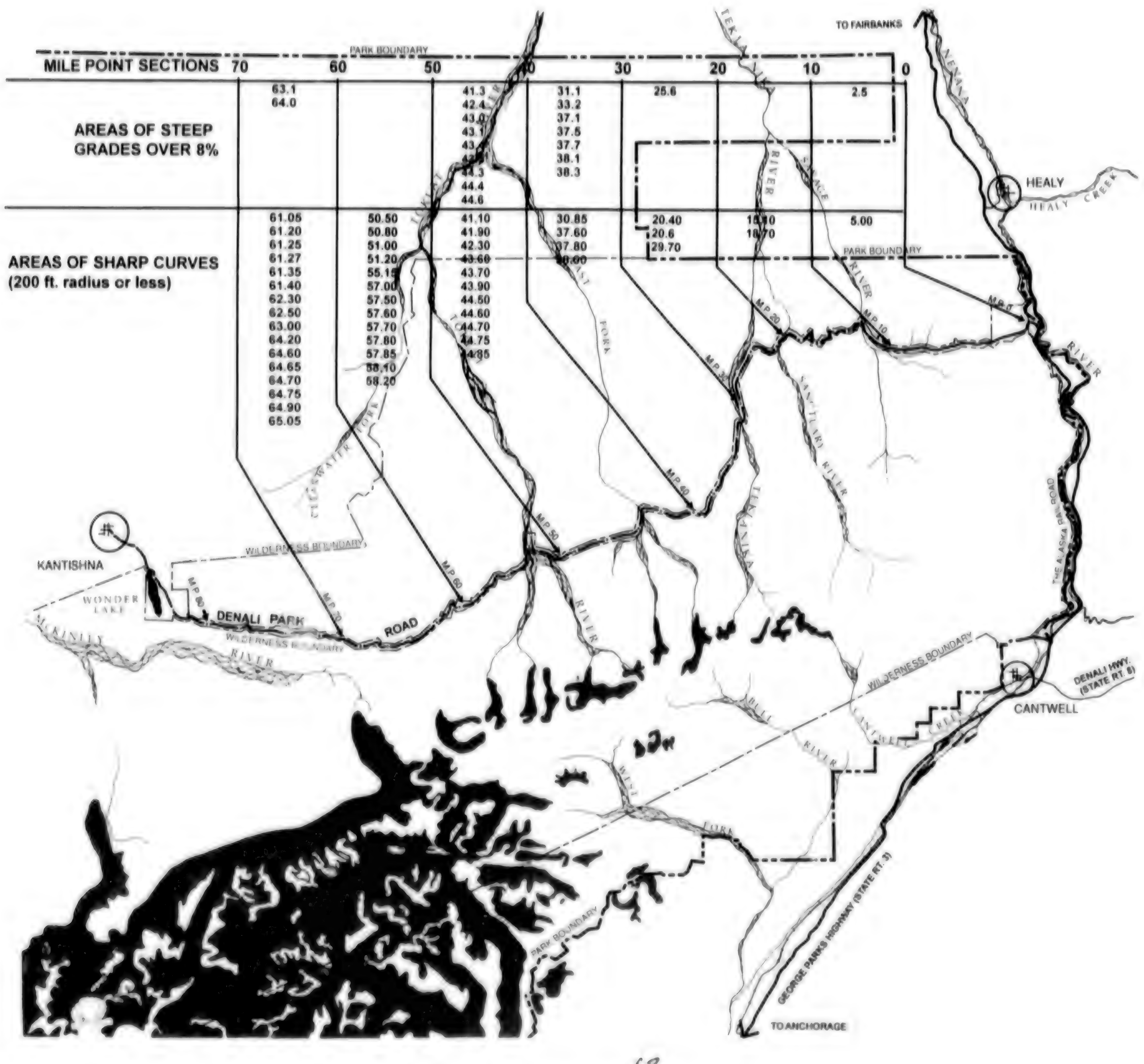


Tight curves and steep grades are found on Sable and Polychrome passes.

The rugged condition of the road contributes to a visitor's sense of adventure. The special feeling of being allowed to experience nature in its most undisturbed state is heightened by the road's condition and the gentle way it is situated within the vast surrounding landscape. The experience of riding in a bus on the park road is a once-in-a-lifetime event for most passengers. Riding along the road, even the transition from a relatively more modern gravel road to a narrower, more primitive dirt and gravel road at Teklanika is noticeable. A paved or widened gravel surface would make the experience less unique and would detract from the wilderness aspect of the experience.

Many sections of steep grades and sharp curves are found along the road other than on the major passes. The accompanying map indicates locations with curve radius under 200 feet or grades in excess of 8%. Tight curves and steep grades affect the performance and feasibility of

DENALI ROAD CONDITIONS SUMMARY (GRADES & CURVES)



MILE POINT SECTIONS	70	60	50	40	30	20	10	0
AREAS OF STEEP GRADES OVER 8%	63.1 64.0		41.3 42.4 43.0 43.1 43.[illegible] [illegible] 44.3 44.4 44.6	31.1 33.2 37.1 37.5 37.7 38.1 38.3	25.6		2.5	
AREAS OF SHARP CURVES (200 ft. radius or less)	61.05 61.20 61.25 61.27 61.35 61.40 62.30 62.50 63.00 64.20 64.60 64.65 64.70 64.75 64.90 65.05	50.50 50.80 51.00 51.20 55.15 57.00 57.50 57.60 57.70 57.80 57.85 58.10 58.20	41.10 41.90 42.30 43.60 43.70 43.90 44.50 44.60 44.70 44.75 44.85	30.85 37.60 37.80 38.00	20.40 20.6 29.70	18.[illegible]0 18.70	5.00	

NOTE: Areas not evaluated for steep grades or sharp curves due to lack of information include the following:

Mile Points
31.3 to 33.20
35.10 to 36.60
39.20 to 40.60
45.00 to 48.60
51.80 to 52.90
66.00 to 89.00

0 1 5 10 MILES

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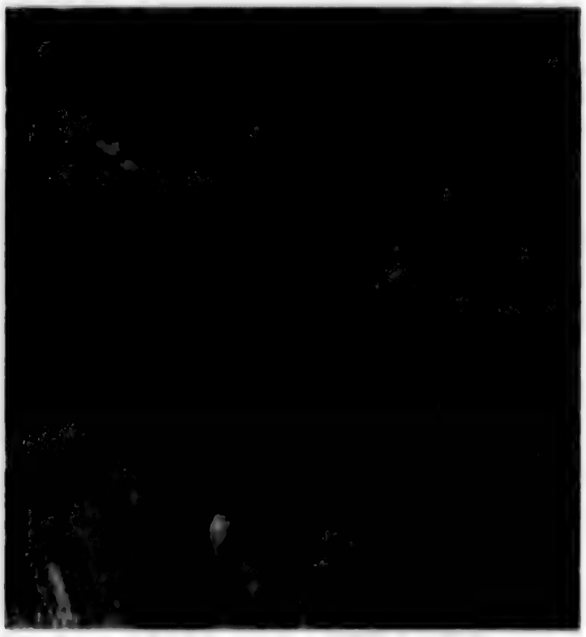
some fixed guideway transit modes and could result in the need for a fixed guideway system to leave the road corridor and enter the designated wilderness. These conditions also limit sight distances and could affect the operation of large vehicles.



Traveling along the park road gives visitors a sense of adventure.

Visitor Parking Facilities

Visitor parking is provided at several locations in the developed area of the park near the entrance and at the Savage River Bridge. Scattered pullouts along the paved section of the road provide access to interpretive signs and viewpoints. The primary visitor parking areas include the following:

- Riley Creek (156 parking spaces). This mostly gravel lot is sometimes inefficiently used due to a lack of striping. It serves as long-term parking for overnight campers using the shuttle bus system to access the park interior, and for day-use shuttle riders who have been unable to find a parking space at the visitor access center.

- Visitor Access Center (VAC). The parking lot for the center includes 130 automobile spaces and 144 RV spaces. The lot serves dual purposes: as short-term parking for visitors seeking park orientation and reservations for camping and/or shuttle rides, and as long-term parking for day use visitors riding the NPS shuttles that originate at the center. The lot is not divided according to function, resulting in some conflict between short- and long-term uses.

- Denali Park Hotel (71 spaces). This parking lot is adjacent to the hotel and serves a few overnight guests who have driven to the park and short-term parking for visitor services at the hotel.

- Denali National Park and Preserve Headquarters (10 - 15 spaces). This small lot provides short-term parking for visitors to headquarters and visitors to the dog sled team kennel area who have not ridden the special shuttle bus.

- Savage River Bridge. A paved parking area (14 spaces) on the east side of the river and an informal gravel parking area (15 spaces) on the west side, provide access to hiking trails used by a few park visitors.

TRANSPORTATION SERVICES

Transportation services within Denali National Park and Preserve are primarily provided by ARA Leisure Services as a part of the park concession contract and by Mayflower Transportation Services under contract to the Park Service. Buses along the park road are also operated by lodging operators in Kantishna.

Several types of circulator bus services are provided in the park frontcountry, and five types of tour and shuttle bus services are operated to the park interior. The transportation services into the park interior are regulated by a vehicle trip allocation system.

Each of the major transportation services operating within the park front country and into the park interior are described below.

Parking spaces are usually available at Riley Creek.

ARA Leisure Services Bus Operations

ARA runs two tour services into the park interior and a courtesy transportation system between front country facilities and lodging outside the park. The ARA services are used primarily by visitors on package tours to the park.

ARA Wilderness Tour. The wilderness tour operates from the Denali Park Hotel to either Stony Hill Overlook (mile 62) or the Toklat River (mile 53). If Mt. McKinley is visible, all Wilderness Tour buses will travel to Stony Hill to view the peak; otherwise all buses turn back at Toklat. Round-trip travel time on the tour is approximately six to seven hours. Departures are scheduled to coincide with the schedules of package tours and with the operation of the Alaska Railroad, which has a scheduled 12:00 pm arrival from Fairbanks and a 4:00 pm arrival from Anchorage. Tour bus departures vary on a daily basis and tend to be concentrated in the early morning and late afternoon. Tour buses tend to leave in closely spaced platoons, which leads to bunching of buses at wildlife viewing opportunities and rest stops.

ARA maintains a fleet of 32 buses, with 20 dedicated to wilderness tour operations. Some buses will be used twice during a single day for early morning and late afternoon tours. The buses have 48- and 52-passenger configurations. ARA plans to convert the entire fleet to the larger capacity. Bus seats are designed for adults, although the buses are derivatives of a standard school bus design.

The visitor access center lot serves both short-term and all-day parkers.

The tour offers visitors opportunities to see wildlife and scenery with informative interpretation provided by the drivers. ARA drivers receive formal training in interpretation and are expected to provide an extensive narration to passengers. Passengers also receive a box lunch as part of their tour. Many unscheduled stops are made for wildlife viewing, with the typical stop lasting three to five minutes. Passengers are given opportunities to take photographs, and the tour driver will offer explanations of the wildlife being viewed. The buses provide a significantly higher viewing platform than automobiles, affording a better chance to see wildlife.

Passengers are not allowed to leave the tour buses en-route, except at scheduled rest stops. All passengers remain with the same bus for the duration of the tour.

Tour bus reservations are allocated to area lodging facilities in proportion to the number of

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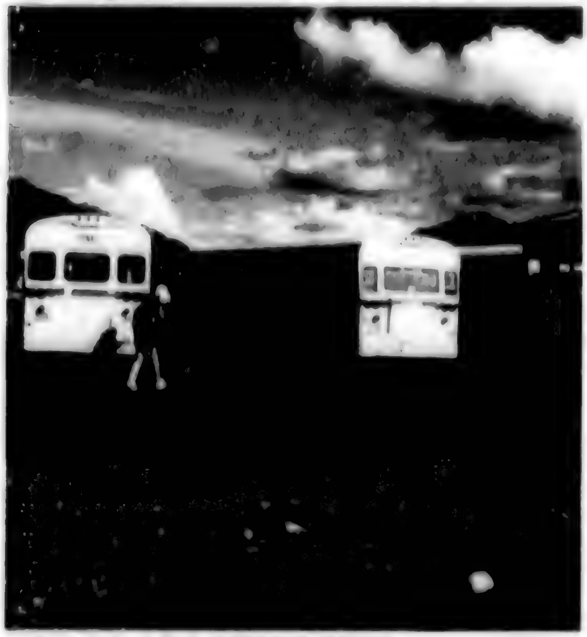
rooms. Reservations for seats are made starting in October for the following season. Some tours will start at a lodging site outside the park if all or most seats are allocated to that site. Tickets for the tour cost $45.00 for adults and $22.00 for children and include the park admission fee and a box lunch. A limited number of standby seats are available daily. No formal information is available to visitors not on package tours regarding these standby seats.


ARA maintains a fleet of 32 Bluebird buses.

The National Park Service allows 2,089 wildlife tour bus trips to be made into the park during the peak season. On a typical day 20 to 24 wildlife tour trips will be made into the park, with most seats occupied.

ARA Natural History Tour. The natural history tour operates between the Denali Park Hotel and Primrose Ridge, about 2.5 miles beyond the Savage River check station. On clear days Mt. McKinley can be seen from this point. Round trip time for the Natural History Tour is about three hours. On an average day during the 1992 season, three to five Natural History Tour trips were made.

The natural history tour provides a shorter version of the wilderness tour. The narration by the driver focusses on the natural and cultural history of the Denali area. Wildlife viewing opportunities exist, but not to the extent offered by the wilderness tour. This tour is viewed as a future "relief valve" for demand for package tour access to the park that cannot be accommodated within the allocation of vehicle trips into the park interior.

Tickets for the shorter tour are acquired by reservation and are also available from the ARA tour desk at the Denali Park Hotel. The 1992 season rate for the natural history tour was $25.00 for adults and $14.00 for children. ARA uses the same type of buses for this tour as for the wilderness tour. The 365 natural history tour trips made during the 1992 season generally had additional seats available.

Courtesy Transportation. ARA provides daily courtesy bus service between all of their hotel units and the park. Nine routes and approximately 83 one-way trips per day provide connections between the Denali Park Hotel, McKinley Chalets, McKinley Village, and the Alaska Railroad depot. Passengers arriving by train will often be taken by courtesy shuttle directly to their Wilderness Tour bus while luggage is transferred to the hotel. Schedules are periodically changed to accommodate daily demand levels and train arrivals. Twelve buses from the ARA fleet are dedicated to courtesy transportation.

Courtesy transportation is provided between the park and hotels.

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The ARA transportation services are funded through fares charged to passengers. The fares are largely included in package tour rates and may not be readily apparent to the individual visitors. Information to compare costs to revenues is not available for ARA operations.

NPS Visitor Transportation System Operations

The Park Service offers several VTS routes that are free to visitors paying the park entry fee. These include shuttle operations between frontcountry activity points and tour operations into the park interior for day use and overnight visitors. The NPS system is operated by a private entity under contract to the Park Service. Each year adjustments are made in the service to better meet the needs of Denali visitors. For the first time, a full-time NPS staff person was assigned to coordinate the VTS services in 1992. That assignment is becoming increasingly important as visitation levels approach the capacity of the park's transportation systems.

Shuttles to Eielson and Wonder Lake. The NPS shuttle system for day use visitors to the park interior begins at the visitor access center and travels to Eielson Visitor Center or to Wonder Lake. During the peak season, 19 daily shuttle trips are made to Eielson and six to Wonder Lake. The 132-mile round trip to Eielson takes about eight hours. Wonder Lake shuttle riders spend about 11 hours on the 170-mile round-trip to the far western end of the park road.

A 75-bus fleet is maintained by the contractor for the shuttle system and other transportation services in the park. Buses typically make a shuttle trip on one day and then are idle for the following day. Drivers and buses are generally assigned on a one-to-one basis. The service is provided with school buses that are used for the transportation of Alaska public school students during the winter months. The only modification to the school buses is wider spacing of the bench seats to provide additional leg room.

The buses used for day use shuttle operation in 1992 had a capacity of 44 seats. The 1993 shuttle contract provides 48-passenger buses. Approximately 15% of the seats are left vacant at departure time. The vacancies are largely caused by no-shows and are intentionally left unfilled to leave room for passengers who may choose to leave a bus and board a different one and for overnight campers who may freely board any shuttle once they have travelled into the park interior.

The NPS shuttle system provides visitor access to hiking, wildlife viewing, and scenic resources in the park. The shuttle designation implies that passengers can get off the vehicle at one or more points along the route, reboarding other shuttles to move on or return to the frontcountry. In practice, less than 10% of the shuttle system passengers leave the buses except at scheduled rest stops. The shuttle system operates essentially as a tour for most passengers.

The NPS shuttle system uses school buses.

Although most shuttle passengers remain with their original bus, some visitors do take advantage of the opportunity to experience the vast wilderness expanse of the park directly. Visitors can request to be let off the bus at any point except within 0.5 mile of a wildlife sighting. A 5-mile section of the road at Sable Pass has been designated a critical wildlife

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habitat area (for bear) and is closed to access on foot. The ability to allow visitors free access to the wilderness from any point on the park road is one of the major advantages of the current shuttle system.

Accommodating passengers who have left their original bus and want to travel on into the park or back out on a different bus has been problematic. In past seasons, visitors would have to wait for several buses to pass before being picked up because of a lack of turnover in bus seats. The current practice of not filling seats vacated by no-show passengers has largely solved that problem. However, leaving a substantial number of seats vacant reduces the capacity of the system to transport visitors to the park interior.

The shuttles are equipped with microphones and a speaker system. NPS shuttle drivers are not required to provide narration during the trip, but many do. The visitor's experience of the park varies according to which shuttle trip they happen to take. No refreshments are offered on the bus or at the rest stops along the way. Rest stops are scheduled at one to two hour intervals along the route. As with the ARA wilderness tour, many informal stops are made for wildlife viewing and photography. Due to the volume of buses on the road, several buses may be stopped at a viewing site. The resulting concentration of buses can lead to undesirable levels of dust around some of the buses and a sense of crowding.

Shuttle reservations can only be made in-person at the visitor access center, except for two daily bus trips primarily serving Alaska residents who have signed up at outlets in Anchorage or Fairbanks. Tickets are distributed on a first come, first served basis and must be used to board the shuttles on the first 17 miles of the road. During the peak season, by the end of the current day, most buses for the following one and one-half days will have been filled.

NPS Camper Shuttles. A special shuttle system is provided for visitors with campground and backcountry reservations for overnight stays in the park interior. These buses serve the four campground locations beyond Savage River and the 43 backcountry units in the park interior. The camper bus trips start at Riley Creek, where visitors are directed to park for long-term stays.

Several rows of seats have been removed from the standard shuttle buses to make room for camping and backpacking equipment. As a result, the seating capacity of the camper buses is 28. The six daily camper bus trips are staggered throughout the day, beginning at 7:10 am. The last trip leaves the Riley Creek Campground parking area at 3:40 pm. Although they are primarily intended for shuttling campers and backpackers to and from their overnight camps, the camper buses will pick up other visitors in the park interior as space allows. Camper buses will stop for wildlife viewing and photography as do the other shuttles. The camper buses also make stops at the designated rest areas along the park road.

Special shuttles are provided for campers.

Tickets for the camper buses are obtained at the visitor access center as part of the campground or backcountry permitting process. No separate fee is charged for the camper bus trip into or out of the park for visitors with camping reservations beyond Savage River. Reservations for campgrounds and backcountry units are accepted in person up to two days in advance.

On a typical day during peak season, visitors may wait for two days or more to obtain a reservation for camping in the park.

Including the regular shuttles and camper buses, a total of 3,594 trips were made by NPS buses beyond Savage River during the 1992 season. The combined total of ARA wilderness tours and NPS shuttles beyond Savage River was 5,700.

"Loop Bus" Frontcountry Circulator. The loop bus is a single small school bus with a 16-passenger capacity that provides service between Riley Creek Campground, the visitor access center, the Denali Park Hotel, the Alaska Railroad depot, and the Horseshoe Lake trailhead. The bus makes a full loop every 30 minutes between 6:30 am and 9:30 pm. This free service is intended to move visitors between key facilities in the front country and to provide a connection between the overflow parking area at Riley Creek and the shuttle bus departure point at the visitor access center.

The loop bus frontcountry shuttle provides access to overflow parking at Riley Creek.

Dog Demonstration Buses. Up to three demonstrations are scheduled each day at the dog kennels near park headquarters. These demonstrations allow visitors to learn about the Denali dogsled teams, the care and training of the dogs, and the use of dogsleds for winter travel in the park. Limited parking in the headquarters area makes access to the demonstrations difficult by private vehicle.

Buses leave the visitor access center one half hour before the scheduled demonstration times. Varying numbers of buses are allocated to the service depending on projected demand. The one-way trip of 3 miles takes an average of 10 minutes.

The dog demonstrations and frontcountry activities served by the loop bus have become increasingly popular as visitation to the park has increased and waiting time for access to the park interior has increased.

NPS visitor transportation services are funded through annual appropriations as part of the Denali operating budget. The total cost of these services in 1992 was $1.7 million. Cost per passenger carried averaged $17.00 for the shuttle services into the park interior and $2.85 for the dog demonstration shuttles. A cost per trip is not available for the loop shuttle bus since passengers are not counted.[7]

Other Transportation Services

Other lodging and tour operators provide courtesy shuttles between lodging facilities and points inside the park. Princess Tours and WestTours (a Grayline subsidiary) are the two largest tour operators, offering special tour cars on the Alaska Railroad. Kantishna lodging operators also offer bus service from the park entrance to their facilities at the end of the park road.

TRANSPORTATION CONDITIONS

In the past ten years the number of visitors traveling into the park interior has doubled, and there has been an even greater increase in the number of recreational visits as estimated by traffic counts on the park entrance road. This increase has been accompanied by an overall decline in the volume of traffic using the road in the park interior.

Since the completion of the *General Management Plan* for Denali in 1986, traffic has been reduced by restricting access to the shuttle system for all campgrounds in the park interior except for Teklanika. At Teklanika, a minimum three-day stay has been instituted to further reduce private vehicular traffic. NPS administrative traffic also has been closely managed, resulting in an 18% reduction in NPS vehicle trips to go along with a 55% reduction in private vehicle traffic since 1984.

Traffic on the park road has declined since 1984 while visitation has grown.

The increase in visitation to the park has been made possible by expanded use of the ARA tours and NPS shuttles. The combined volume of bus trips into the park beyond Primrose Ridge increased by more than 40% from 1984 to 1988. The number of passengers on each bus has increased as well. The ratio of visitors to bus trips has increased from about 30 in 1984 to more than 38 in 1992.

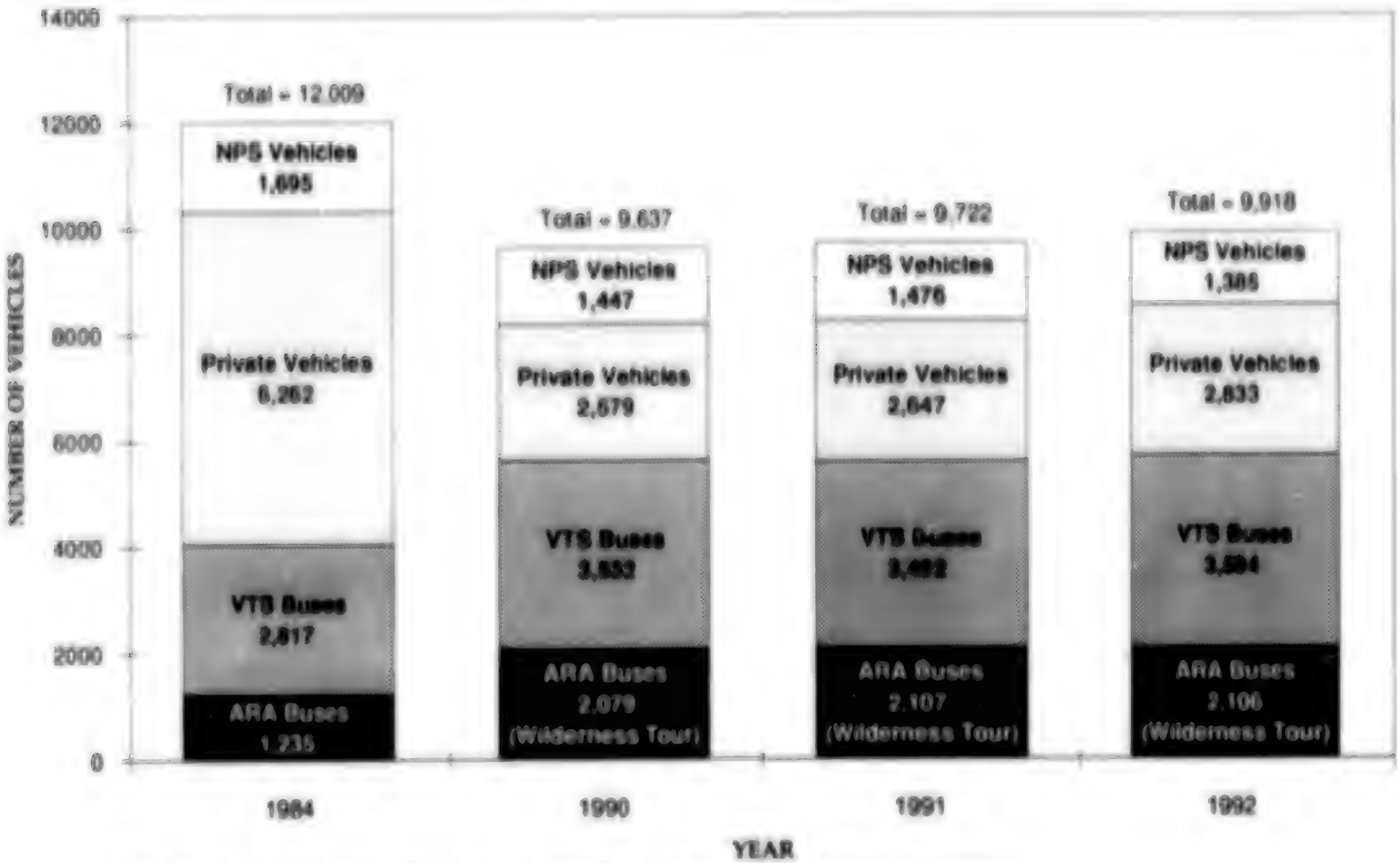
Although careful management of transportation resources has allowed visitation to increase while maintaining the essential wilderness character of Denali, the transportation system is showing signs of stress. Figure 6 shows traffic volumes passing Savage River and points beyond Primrose Ridge. Although traffic is down substantially from 1984 levels, traffic volumes increased by about 3% from 1991 to 1992.

Figure 7 shows a more detailed breakdown of the current traffic. Very little additional capacity for bus traffic increases exists. A major expansion of visitor-related facilities in Kantishna could result in increased private vehicular traffic along the road and an accompanying need to reduce bus access and visitor carrying capacity.

Traffic volumes along the park road are near practical limits.

Although there is limited opportunity to increase the number of vehicles serving visitors, there are possibilities to squeeze modest numbers of additional passengers onto the existing visitor transportation system while using the existing equipment. Figure 8 shows the 1992 passenger volumes carried and the actual planned capacity of the transit services. ARA wilderness tours operated essentially at capacity in 1992, however the natural history tours could have accommodated 42% more passengers. Overall, the NPS systems operated at 85 percent of planned capacity. (The planned capacity includes provision of empty seats for circulation in the park interior.) The occasional surplus of seating available on camper buses may accommodate some additional day use passengers.

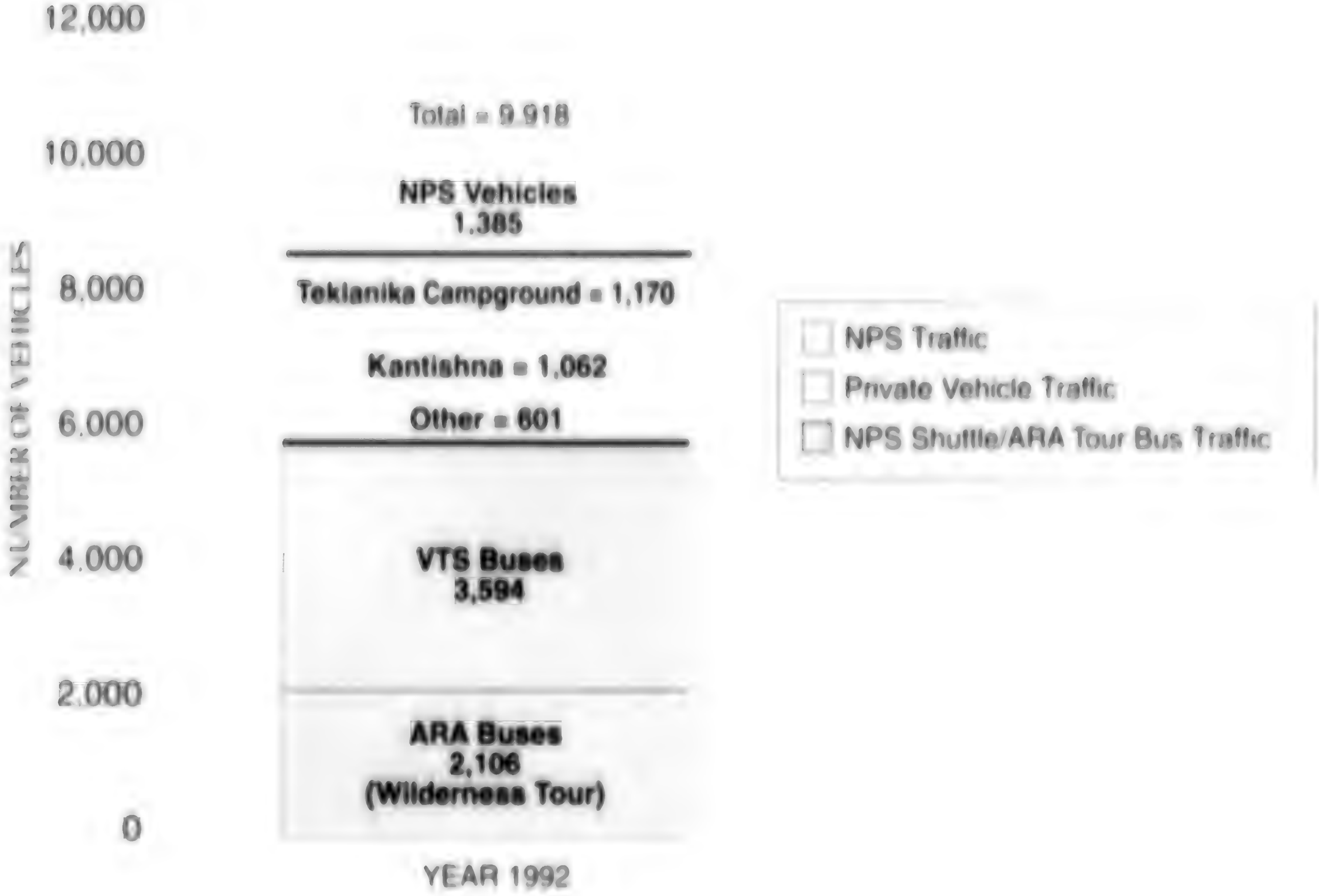
Figure 6: Denali National Park and Preserve
Traffic beyond Savage River



NOTE: ARA bus trip totals do not include trips during final four days of visitor season, but do include training trips.
SOURCE: Savage River station counts, Denali staff. *General Management Plan* (1986)

Figure 7: Denali National Park and Preserve

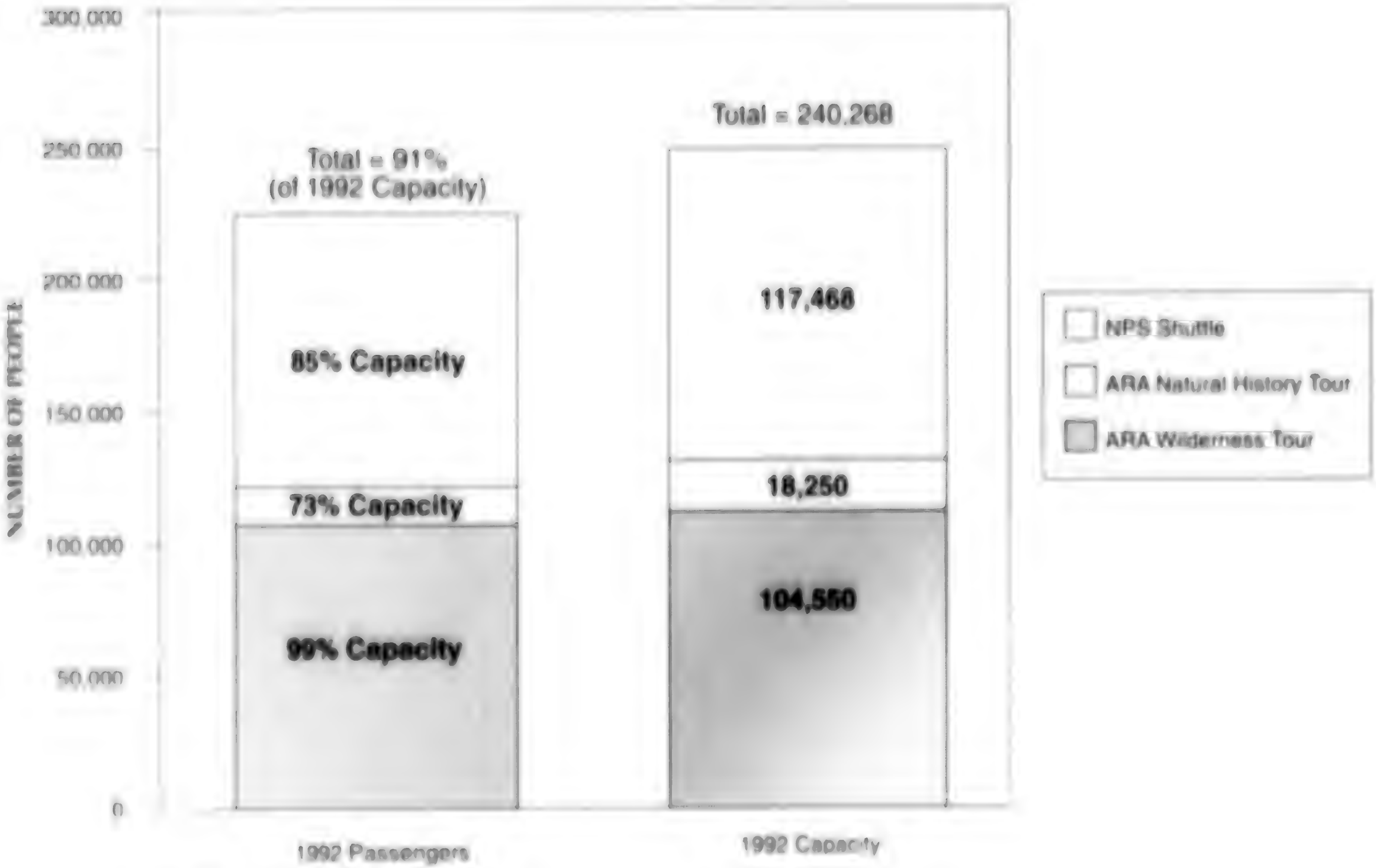
Traffic Passing Savage River



SOURCE: Savage River station count, Denali staff, *General Management Plan*

Figure 8: Denali National Park and Preserve

Shuttle/Tour Bus Capacity and Usage



SOURCE: Denali staff data base, ARA staff

Although it is possible that additional visitor growth could be accommodated by further streamlining the VTS operation, higher use levels would be accompanied by longer waits for access to the park. Also, demand would increase for overtaxed overnight facilities and the percentage of potential park visitors who leave without gaining access to the park interior due to time constraints would increase. An improved reservation system and greater availability of park use information to prospective visitors in advance of their arrival is crucial if the scarce transportation resources available to the park are to be used to their greatest advantage.

Further evidence of visitation growth is provided by the increasingly crowded visitor parking facilities. The two most important visitor parking areas are Riley Creek and the visitor access center. The VAC parking area provides short-term parking for visitors making shuttle, campground, and backcountry reservations and to accommodate some long-term parkers using the shuttle system. Riley Creek serves long-term parkers, primarily those with camp sites or backcountry permits who are using the camper shuttle bus. Riley Creek also acts as an overflow lot for regular shuttle passengers and some short-term parkers. The frontcountry loop bus provides a crucial link between Riley Creek and the visitor access center.

Figure 9 shows the number of vehicles parked at the VAC lot on a typical day during the 1992 season. From about noon to 5:00 pm, the lot is fully occupied. Recreational vehicles (RVs) represent a larger proportion of the total vehicles parked in the lot than in a typical national park setting. The VAC lot is mostly used by short term parkers staying under one hour (34%) and long-term parkers staying more than five hours (40%). A total of 580 vehicles were observed using the lot, indicating that the average space was occupied 2.1 times during the day.

On the same day the VAC lot was overcrowded, many spaces were unused at Riley Creek. Out of an estimated capacity of 156 spaces, a maximum of 84 were occupied, leaving 72 open. Very few RVs used the Riley Creek lot, and more than 80% of the parkers stayed more than five hours (see figure 10).

Despite the availability of the loop bus connecting the two lots, the visitor access center is considered to be a more desirable location to park because the shuttle system terminal is there. More visitors might be encouraged to park at Riley Creek for the duration of the shuttle tour if the route started there. It is normally desirable to have the ticketing point and route terminal at the same location for a transit system. However, in Denali, the proximity of ticketing and boarding points is not important because most passengers will board their shuttle bus one or two days after getting their tickets.

ENVIRONMENTAL CONDITIONS

The following overview of resources in Denali summarizes and interprets information derived through published sources, site visits, and discussions with park and other NPS personnel. Environmental issues addressed include air and water quality, soils, noise, vegetation, wildlife, cultural and visual resources. Several maps, at the end of this chapter, illustrate the significant environmental issues in the frontcountry, park interior, and on the south slope.

Overview

Denali contains resources of international significance - the highest mountain on the North American continent and a very large continuously protected ecosystem. It encompasses a region of diverse igneous, metamorphic and sedimentary rocks ranging in age from the Recent to units that may be as old as Precambrian[1]. Soil types within the park vary as a result of parent material, topography and vegetative cover. Soils can be generally classified as mountain and tundra soils, bog soils, and forest soils. Significant glacial and seismic processes are actively changing the landscape of the park.

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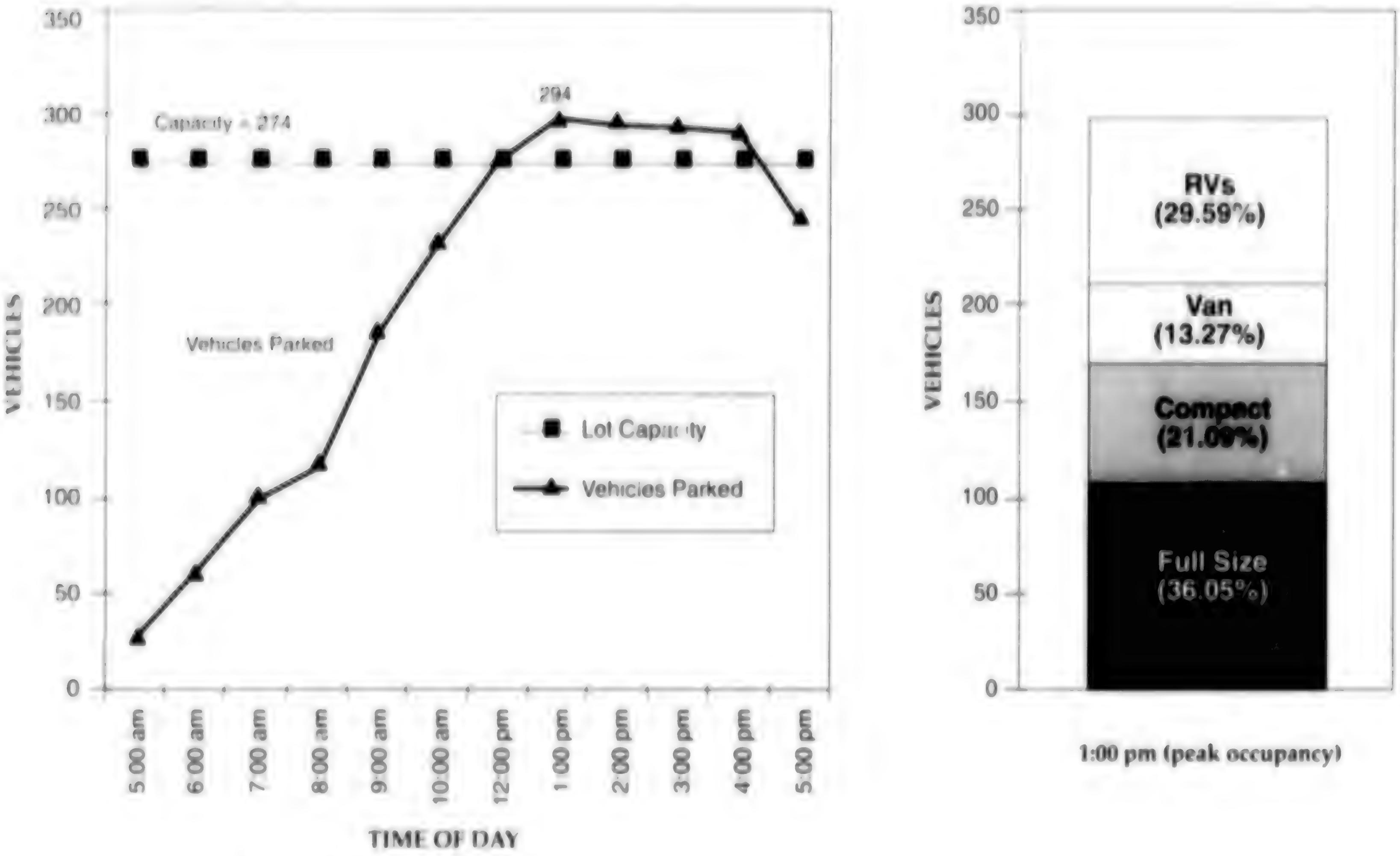
Figure 9: Denali National Park and Preserve

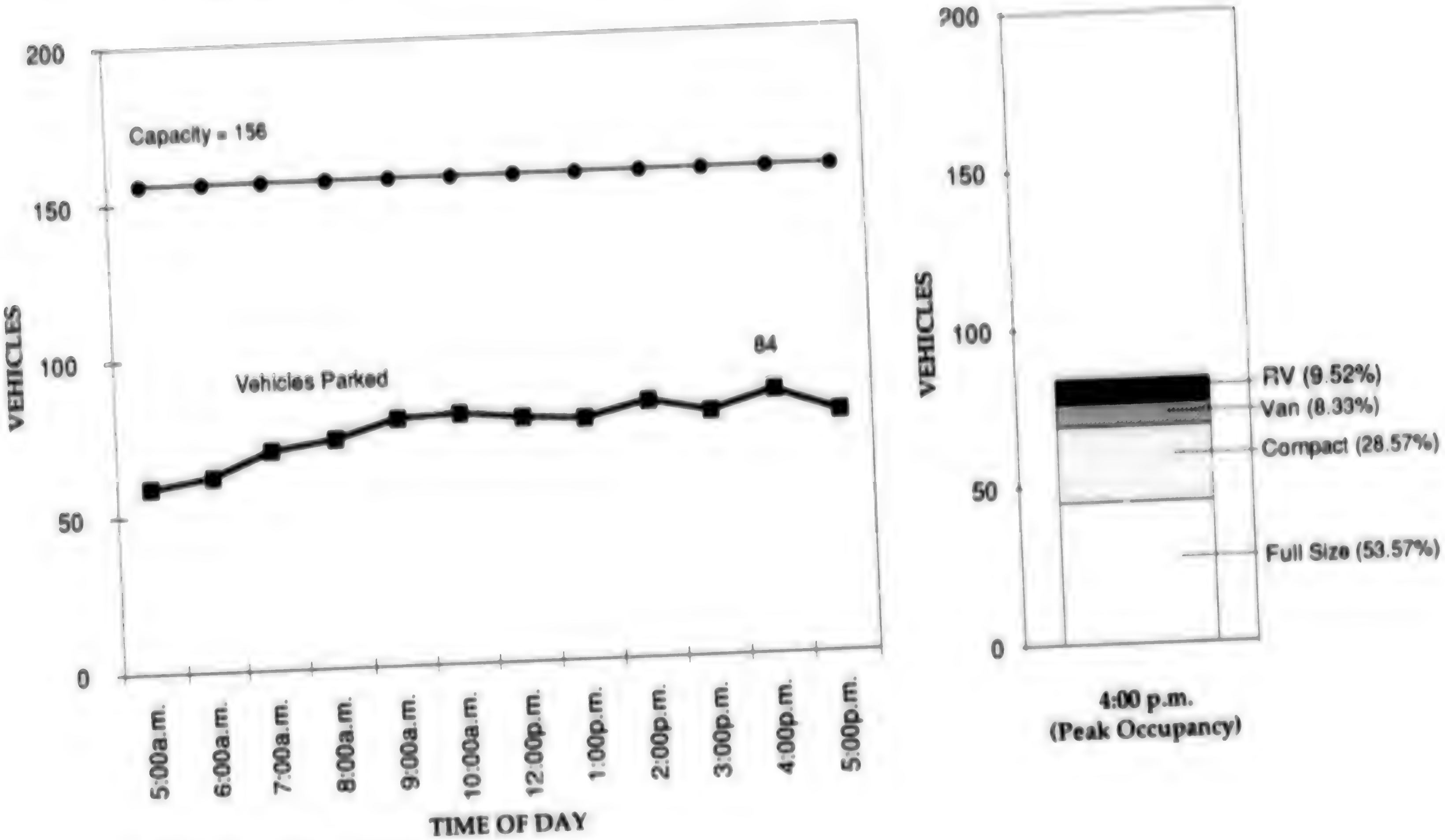
Parking Occupancy at Visitor Access Center



SOURCE: July 31, 1992 field survey (BRW, Inc.)

Figure 10: Denali National Park and Preserve

Parking Occupancy at Riley Creek Parking Area



SOURCE: July 31, 1992 field survey (BRW, Inc.)

The park lies within two major climate zones of Alaska, which are separated by the Alaska Range. To the north of the mountains the climate is continental, characterized by extremes in temperature, calm air movements, and light precipitation. South of the range, a maritime climate is influenced by the Pacific Ocean and the Gulf of Alaska. Strong winds, heavy precipitation, and less seasonal fluctuation in temperature are more common in this region. Flash flooding has occurred in the park although, thunderstorms are rare. The northern national preserve lands include portions of the subarctic's heavily forested lightning belt; thus, fire is important to the ecosystem.

The existing road corridor spans three major vegetative associations along its course. These include the taiga (or boreal forest), moist tundra and alpine tundra. Boreal forest types are generally found below 2,500 feet along the first 7 miles of the existing road and in isolated, narrow strips that parallel each of the river bottoms in the park interior.

The broad valley along the park road provides unique wildlife habitat.

The road corridor traverses a broad valley of unique wildlife habitat that supports significant populations of Dall sheep, caribou, moose, grizzly bears, and wolves, along with smaller mammals such as red fox, lynx, wolverine, snowshoe hare, beaver, porcupine, marmot, pika, and ground squirrels. Significant habitat types include (1) riparian forest adjacent to river corridors, which provide habitat for a variety of species including grizzly bears, (2) wetland and bog areas for moose, (3) steep vegetated slopes near river corridors for Dall sheep, and (4) the boreal forest areas for moose calving and grizzly bears.

The park road crosses several north-flowing rivers that are characterized by broad gravel bars, braided, shifting channels, and heavy silt loads. The majority of these rivers originate from glaciers in the Alaska Range. Clear streams occur sporadically throughout the park, often as tributaries to major glacial streams or rivers. The sources of these streams are primarily snowmelt and precipitation. Fish populations in the glacial rivers are generally low because of the highly turbid waters and few pools or riffles for fish rearing. Better fish habitat is found in the clear-running streams.

More than 155 species of birds summer in the park. Denali has the highest concentration of golden eagle nests in North America. Many species, such as loons, grebes, ducks, geese, cranes, and swans, nest north of the park and stop in the park primarily for nesting and rearing of young during the summer.

The entire road corridor is within a landscape setting of significant visual quality. The pristine conditions, the striking physiographic and hydrologic features, and the presence and variety of wildlife all contribute to the extraordinary wilderness visual character of the park.

There are approximately 100 known cultural sites and structural units or complexes in the park and preserve. These sites may constitute only a fraction of what actually exists within the park. Prehistoric sites date from occupation of migratory big game hunters who used the area on a seasonal basis possibly as early as 10,000 years ago. Historic resources are associated with mining, hunting and early park activities, including structures and buildings currently on

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or eligible for listing on the National Register of Historic Places.

The Denali wilderness is a class I airshed the preserve is class II. Air quality within the park is considered to be excellent.

Significant Natural Resources

The overriding natural resource offered by the park is its vast area of land in pristine, unaltered condition, free from human influence on natural processes. The sole intrusion of man into the ecosystem of Denali is the narrow park road and the limited volume of traffic it carries. The influence of the road and man's use of it on the landscape and on the abundant wildlife is minimal. However, past studies have indicated that the balance between use and preservation is delicate, even in the relatively unspoiled environment of Denali.[4]

Specific resources of note include: sensitive tundra habitat, the limited areas of forest, nonglacial stream water quality and aquatic habitat; wildlife use and migration areas, national register historic districts and structures, and views of wildlife and Mt. McKinley. No rare or endangered species of plant, fish, bird, or mammal is known to nest or migrate within the road corridor. There have been a few unconfirmed reports of peregrine falcons moving through the park. Due to their abundance, grizzly bears, wolves, the golden and bald eagles, and the trumpeter swan are not considered to be rare or endangered in Alaska.

Significant bear use areas include: Sable Pass from spring to fall (especially sows and cubs), the taiga habitat during the spring moose calving season; the Toklat River corridor along the park road in the fall; and broad areas of the south slope from spring through fall.

Heavily used river corridors traveled by bear, moose, caribou, and other mammals include the Savage, Sanctuary, Toklat, Teklanika, and Chulitna rivers. The Chulitna River is a significant use corridor for eagles, and south slope wetlands and streams provide significant year-round habitat for moose and summer habitat for trumpeter swans. Clearwater streams and pools on the south slope provide abundant fish for grizzly bears. Bears on the south slope of the Alaska Range tend to be larger than those of the same species on the north slope because of the greater food supply. The area surrounding Alder Point, near the toe of the Ruth Glacier, is one example of ideal bear habitat on the south slope.

Rivers in Denali act as wildlife corridors. Clearwater streams provide fish habitat.

Caribou migrate along the existing road corridor during their movement to and from calving areas in the Dunkle Hills on the south side of the Alaska Range. Throughout the summer the caribou move westward, paralleling the road between the Sanctuary River and Wonder Lake. The road follows the east-west valley, which has historically been used for post-calving migration (Tracy 1977). Caribou winter range is in the expansive north and west ranges of the preserve, including areas along the Stampede Trail.

Dall Sheep are found in greatest density east of the Eielson Visitor Center, primarily on high talus slopes and alpine tundra where lambing and rearing occurs. Their winter range is predominantly north of the road in the Outer Range. Summer habitat is in the Outer Range and the Alaska Range. Most migration across the park road occurs in June, primarily between milepost 10 and the Eielson Bluffs.

The taraxacum carneocoloratum, an endangered plant species, occurs at milepost 60.8.

Arctic grayling migrate upstream in spring in clear-running tributaries such as Igloo, Caribou, Little Stony, Hogan, Moose, and Jenny creeks and the Sanctuary River and tributaries to the East Fork, Toklat, and Teklanika rivers. Spawning occurs between late March and mid-July. The Chulitna River, on the south slope of the park, provides significant aquatic habitat for various migrating fish including Dolly Varden, lake trout, king salmon, and chum salmon.

Caribou migrate along the road corridor

Significant Visual Resources

Significant views of Mt. McKinley and the Alaska Range can be seen from most of the passes west of milepost 8.0 along the park road. Variable weather conditions and cloud cover often restrict these views. Areas that are reliable for wildlife observations include the Riley Creek entrance area to park headquarters and near Wonder Lake (moose); Sable Pass (grizzly bear); and Igloo Mountain (Dall sheep), Polychrome Pass, and the slopes east of the Toklat River.

Significant Cultural Resources

The Alaska Range and the Mt. McKinley massif separated Native American Athapaskan-speaking groups who historically used resources that later became part of Denali National Park and Preserve. On the north side of McKinley, three groups used the big game and fish resources: the Upper Koskokwim peoples (now living in Nikolai and Telida), the Koyukon (in the north central portion of the park), and the Tanana. The Tanana people of Nenana have had considerable association with park resources in the northeastern portion of Denali, including historic communities just outside the park boundaries and historic and contemporary use of the area for trapping, fishing, and hunting.

The Tanana lived in the communities of Bearpaw and Toklat as late as the 1930s, but they now live elsewhere, including the Nenana environs. Tanana people regularly used the Stampede and Upper Toklat River area of the park.

To the south of Mt. McKinley two Athapaskan - speaking groups used south slope resources. The Upper Tanana people used much of the south slope, and the westernmost band of Ahtna used a small area on the east-central border of the park. The Ahtna were relative newcomers into the Denali environs. Much less is known about historic Native use of the south slope than of the north.

Archaeological resources in Denali include trails and encampment locations of prehistoric man. Trails often followed ridgelines, and encampments were near clearwater streams; however, they also are found on higher slopes in areas away from stream corridors.

Teklanika East and Teklanika West comprise the Teklanika Archaeological District, listed on the National Register of Historic Places. Many of Denali's historic structures are on the List of Classified Structures, which may make them eligible for designation to the National Register. Historic structures of significance relate to two interrelated themes - mining and subsistence hunting and trapping.

Most of the surviving structures, which date between 1905 and 1935, are in the Kantishna Mining District. The administrative history of the park is represented by structures in the park headquarters area which are in the process of being nominated to the National Register of Historic Places. Other historic structures potentially eligible for the National Register are the patrol cabins in the interior of the park dating from 1924 to 1939.

Resource Impacts of Existing Transportation Systems

The existing park road lies north of and parallel to the Alaska Range. The road generally follows an east-west valley that lies between the Alaska Range and its foothills to the north, the Outer Range, and the Wyoming Hills. The east-west corridor crosses several north-flowing rivers and is often on south-facing slopes. The road alignment, its construction and maintenance, and visitor use impact the park resources in several important ways.

Road Alignment. Overall, the park road has relatively little impact on the environment of the park. The road's location takes advantage of south facing slopes and follows existing ground contours. The road is not overly intrusive within the visual context of its surroundings. The road's physical presence causes some concerns, including soil erosion, disruption of natural plant material growth patterns, and fragmentation of some relatively small and uncommon habitat areas.

Along the corridor the cut-and-fill slopes are bare in most locations, contributing to localized erosion and sedimentation. These slopes are visually inconsistent with the surrounding landscape. The narrow cross section of the road beyond the Teklanika River minimizes cut and fill slopes in all but the steepest terrain. Minor changes in the alignment during the life of the road have resulted in some additional habitat encroachment and increased erosion and sedimentation into adjacent drainages. These localized effects are most common on steep slopes at Polychrome Pass and west of Eielson Visitor Center and along the segments of the road that have been improved.

Moisture-seeking willows are found along the roadside in areas where the natural drainage pattern has been interrupted by the raised roadbed or roadside ditches. The road edge is often characterized by variations in species composition and increased plant growth. These habitat changes are generally restricted to the immediate edge of the road.

The parking lots and transportation support facilities, as well as the road itself, have fragmented the boreal forest in the front country of the park. This is specifically a concern for moose and grizzly use in the spring. The impacts of the road and its associated facilities are heightened in the front country because visitor traffic is not restricted and volumes are substantially higher than in the park interior.

Cut-and-fill slopes cause erosion.

Construction/Maintenance. The effects of road construction and maintenance activities include wildlife disturbance (especially in critical seasons) along with increased erosion and sedimentation and isolated habitat damage. The existing park road has a gravel surface, except for a 15-mile paved section between the park entrance and Savage River. The paved segment provides a stable surface with regard to erosion and sedimentation effects. Beyond Savage River, the entire road is built over discontinuous permafrost. Major concerns include areas of rising frost; expansive, poorly drained silt-clay soils; and large ice lenses.

Ongoing repairs are required where the road encounters these conditions. The maintenance and construction activities associated with road repair could increase erosion and sedimentation into clearwater drainage systems. Sedimentation concerns are most significant along Igloo Creek, where the road is in the floodplain and directly adjacent to the riparian corridor, and along Moose Creek near Kantishna, where sedimentation from the road is significant.

A 1986 study concluded that construction activities adversely affect caribou, particularly groups of cows and calves, causing increases in reactive behavior and temporary migration delays[5]. Removal of overflow ice from the roadway can be a problem along the low-lying road sections near streams, particularly where the road affects the natural stream hydrology in Igloo Canyon. The activities associated with ice removal may cause damage to adjacent habitat.

NPS road grading practices minimize the effect on adjacent habitat by using small, site specific crews, grading from the road edge inward (center-casting), sensitizing equipment operators to road edge habitat protection, and active roadside revegetation programs. From the Wonder Lake Ranger Station to Kantishna, however, the rffects of road maintenance are significantly greater on adjacent habitat and stream water quality. The State of Alaska is responsible for maintaining this section of the road.

The grading process eventually removes the repairable surface material. The subsequent need for importing material requires additional borrow sources. The grading also disturbs adjacent habitat by introducing material on unstable and poorly vegetated fill slopes.

A gravel acquisition plan completed in 1993 identifies the Teklanika and Toklat rivers as acceptable sources of gravel for surface materials. Concern for the impacts to wetlands, the visibility of pits, new access road requirements, and intrusion into wilderness-designated lands complicate use of in-park sources. Sand and gravel can be extracted from within national park lands only if no practical opportunity to import these materials is available or if acceptable sources are identified in a park's resource management plan.[6]

Frontcountry facilities have fragmented the boreal forest habitat.

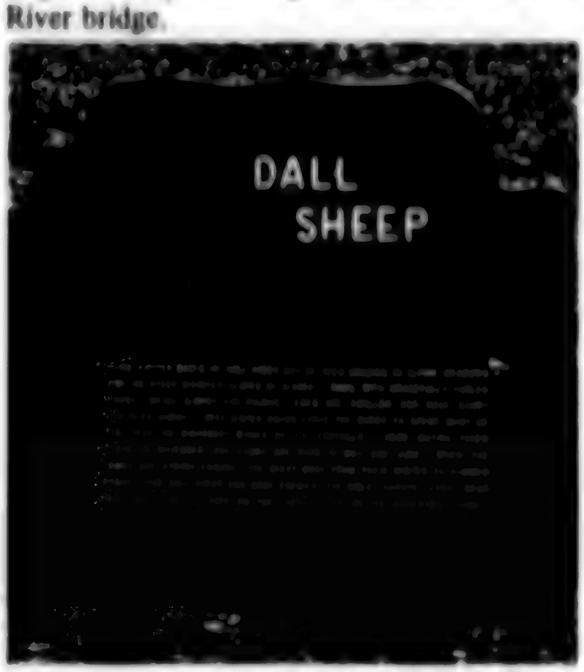
Gravel is commercially available at greater expense outside the park near Cantwell; however, there is growing pressure by local residents to restrict further use of these sources because of the environmental impact of gravel extraction in their community. Regardless of where additional extraction occurs, the potential to affect habitat, water quality, prehistoric sites, and visual resources is significant.

The current NPS goal for road maintenance is to avoid interfering with natural ecosystem processes and plant communities. Areas disturbed by maintenance and construction activities are revegetated to conform to natural surroundings. Research is being conducted to investigate effective revegetation techniques and design criteria for minimizing disturbance and promoting soil stability and revegetation. Overall, these have effectively minimized impacts to Denali's resources.

Visitor Use. The primary consequence of visitor use of Denali is the movement of buses along the park road. The influence of buses on wildlife is the principal concern regarding the impact of visitation on the park's environment. The movement of visitors by buses reduces wildlife disturbance and habitat degradation. The use of buses, as opposed to individual private vehicles, reduces the frequency of vehicle "events" which could change animal movements and behavior patterns. The use of buses also allows the Park Service to prevent individuals from leaving vehicles and making direct contact with the wildlife. Noise and dust levels are reduced, and greater intervals of time with no human activity are created, reducing stress on wildlife migrating across the road corridor. Bus use has helped reduce traffic levels and the potential for accidents. The existing effect on wildlife from vehicles and visitors along the road is apparently minimal as reflected by the abundant wildlife populations within the corridor. In fact, many species have been seen using the road as a travel corridor or foraging area. Increased speeds and higher volumes of traffic over the first 15 miles of paved road have increased the potential for wildlife kills.

Generally, caribou are most sensitive to human presence and interference during the winter and during the spring calving season. During the summer period, caribou behavior is affected by initial encounters with humans after the long winter.

The park road is generally at a lower elevation than prime Dall sheep habitat. As a result, most road-related visitor/sheep interaction occurs during seasonal migrations. Where the road passes through sheep range, sheep have habituated to the traffic and readily cross the road. Sheep occupying ranges away from the road must cross the road during seasonal migrations and have not habituated to traffic, though the road has been a constant presence for over 50 years. In 1938 Adolph Murie predicted that traffic would add to the stress and subsequent energy loss that the sheep naturally experience during migration.[7] Subsequent studies have shown this to be true, and this phenomenon is particularly evident just east of the Toklat River bridge.

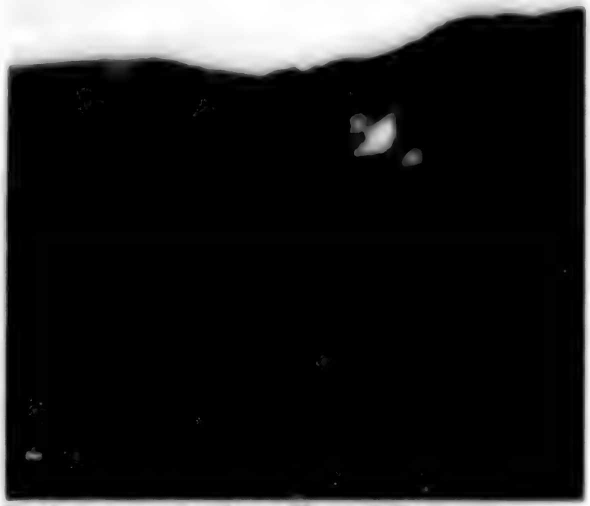


Dall sheep migrate across the park road near the Toklat River

At this location, the sheep are not only affected by the presence of traffic but by the way in which the traffic stacks up near the crossing point of the major migration route. This is one of the best locations for visitors to see the sheep, and long periods of constant vehicle presence result when sheep attempt to move across the road.

Bear and moose appear to be relatively unaffected by the movement of buses along the park road. Smaller animal species have also proven to be indifferent to traffic.

The *General Management Plan* established the Park Service's policy regarding traffic volumes in the park interior. The plan determined that increasing traffic volumes would result in a significant decline in visible wildlife. Studies of road/wildlife interaction indicated that increased traffic between 1971 and 1981 may have caused moose and bear to avoid the road and that increased levels of traffic might eventually disrupt migrating herd movements if time intervals between vehicles become too short. The plan established goals for traffic volume during the peak visitor season at a level 15% above 1984 counts until effects could be monitored and then allowed to increase to a level that does not unacceptably affect wildlife behavior.



Dust is an annoyance and may affect roadside vegetation.

Personal automobile use is allowed during a four-day period at the end of the visitor season. A lottery program is used to distribute 300 daily entry permits for private vehicles. This is a sensitive period for seasonal wildlife events influencing caribou, sheep, and moose. During the falls of 1982 and 1983 when the Park Service allowed unlimited private vehicle access, the increased number of visitors had little influence on the numbers of wildlife seen. However, more wildlife were put to flight, flight distances were increased, more animals were prevented from crossing the road, and visitors stopped near and approached wildlife on foot more often. As a result, access by private vehicles was limited in later years.

In addition to wildlife impacts, the use of the park road generates localized dust and noise concentrations. These conditions may be more of a detriment to visitor experience than a threat to the Denali ecosystem. Dust from vehicles creates a significant visual disturbance along the road during dry weather. Dust reduces short-range visibility and affects the overall quality of longer-range vistas. The most significant dust problems occur on the long straight segments between the Savage and Teklanika Rivers where speeds often exceed the posted 35 mph limit.

Overall, emissions and fugitive dust may be an insignificant contributor to the ambient levels of air pollution in the park due to their short-term and localized nature. However, the temporary effects of fugitive dust on visitor health and enjoyment during dry, still conditions and the impacts of dust deposition on vegetation along the road edge are of concern.

Train movements and whistles, aircraft overflights, and shuttle bus traffic generate the greatest amount of noise in the park. The buses used in the shuttle system can be heard from significant distances, especially in areas with steeper grades where the buses use lower gears. The intrusion of noise is periodic, but relatively frequent along the road corridor.

Concentrated noise is generated by heavy equipment during road maintenance and construction-related activities. The greatest potential for construction noise and activity levels typically occurs during spring snow removal and spring and fall road repair. Noise in developed areas is generated by human activity and transportation systems. Wildlife may be habituated to noise from the road corridor or developed areas (*e.g.*, foraging grizzly bears during the summer), and in other cases, unhabituated populations may avoid these areas (*e.g.*, Dall sheep with seasonal ranges in more remote areas of the park).

In addition to the impacts of vehicular movement and the presence of vehicles on the park road, "social" trails have developed in areas where many visitors move about on foot. These areas include the immediate vicinity of campgrounds and roadside rest areas, and the Eielson Visitor Center. Pedestrian traffic is impacting tundra vegetation and soils and accelerating natural erosion processes in these locations.

SUMMARY OF NATURAL AND CULTURAL RESOURCE IMPACT ISSUES

The park resources and areas most affected by the existing transportation system are summarized below and illustrated on the attached maps. Maps showing wildlife and habitat conditions along the Stampede Road corridor and in an area near the Ruth Glacier adjacent to Denali State Park also are included. The state and other interests have expressed desires to provide visitor access to these areas of the park and preserve.

Segments of the existing road were identified by geographic location and corresponding milepost. Issues were listed if significant resources and areas were impacted by the existing transportation system or if conditions are sensitive to changes in maintenance levels or construction activities.

Riley Creek/Park Headquarters (MP 1 to 8)

- habitat fragmentation resulting from dispersed facilities development
- noise, dust, and human activity, including private vehicles, buses, and pedestrians
- wildlife disturbance from locating facilities within moose calving and bear hunting habitat
- cultural/historic resource sensitivity (national register historic sites)

Savage River Segment (MP 8 - 19)

- disturbing Dall sheep migration and moose activity
- vehicular/pedestrian activity and vehicular speeds
- erosion/sedimentation effects on Jenny Creek water quality

Sanctuary River Segment (MP 19 to 24)

- road crosses through riparian forest wildlife habitat
- river provides significant wildlife habitat and migration corridor
- fugitive dust generated from vehicles
- wildlife and habitat disturbance from personal vehicle access, camping, and social trail development

Teklanika River Segment (MP 24 to 34)

- forested river habitat interrupted by the road
- river provides significant wildlife habitat and migration corridor
- fugitive dust generated from vehicles
- wildlife and habitat disturbance from personal vehicle access, camping, and social trail development
- prehistoric and historic resource sensitivity (registered archaeological district) and potential disturbance

Igloo Creek Segment (MP 34 to 39)

- direct contact of riparian habitat and the road and previous alteration of the stream banks and hydrologic processes along Igloo Creek
- Dall sheep migration disturbed by frequent vehicles
- fugitive dust generated from vehicles
- water quality degradation from sedimentation generated during road grading

Sable Pass Segment (MP 39 to 43)

- significant grizzly bear habitat adjacent to the road
- fugitive dust generated from vehicles

Polychrome Pass Segment (MP 43 - 48)

- pedestrian/maintenance activity including effects of social trails on tundra soil, vegetation, and wildlife
- significant panoramic views
- ice lenses/permafrost locations adjacent to rest stop area

Toklat River Segment (MP 48 to 59)

- Dall sheep migration disturbed by frequent vehicles
- river provides a significant wildlife habitat and migration corridor for most park species

34

- wildlife disturbance from employee housing area and gravel operations

Thoroughfare Pass Segment (MP 59 - 65)

- wildlife disturbance from traffic, including Caribou migration and bear use near Highway Pass
- significant views from Denali overlook at Stony Hill (MP 62)
- dust resulting in effects on air quality, and aesthetics
- erosion/sedimentation at three drainage crossings

Eielson Visitor Center Segment (MP 65 - 69)

- pedestrian activity, including effects of social trails on tundra soil and vegetation
- wildlife disturbance, including caribou migration, and wintering sheep
- significant panoramic views of Mt. McKinley

Wonder Lake Segment (MP 69 - 88)

- pedestrian activity at Wonder Lake Campground, including effects of social trails on soil, habitat, and wildlife
- habitat/wildlife disturbance, including bird nesting/use areas, and caribou migration
- sedimentation and disturbance to wetlands, beaver ponds, and moose habitat
- significant views of Mt. McKinley and Muldrow Glacier

Kantishna Segment (MP 88 to 92)

- erosion and sedimentation from road construction and maintenance operations
- habitat degradation resulting from dispersed facilities development
- wildlife disturbance from dispersed development and uncontrolled human activity
- prehistoric and historic resource sensitivity (national register sites) and potential disturbance

The following maps identify those significant resources that could be affected by changes in the transportation system: frontcountry habitat and wildlife issues, north slope wildlife issues, north slope habitat issues, north slope soils/permafrost and cultural issues, south slope bear and moose habitat issues, south slope bird and fish habitat issues, and south slope habitat types.

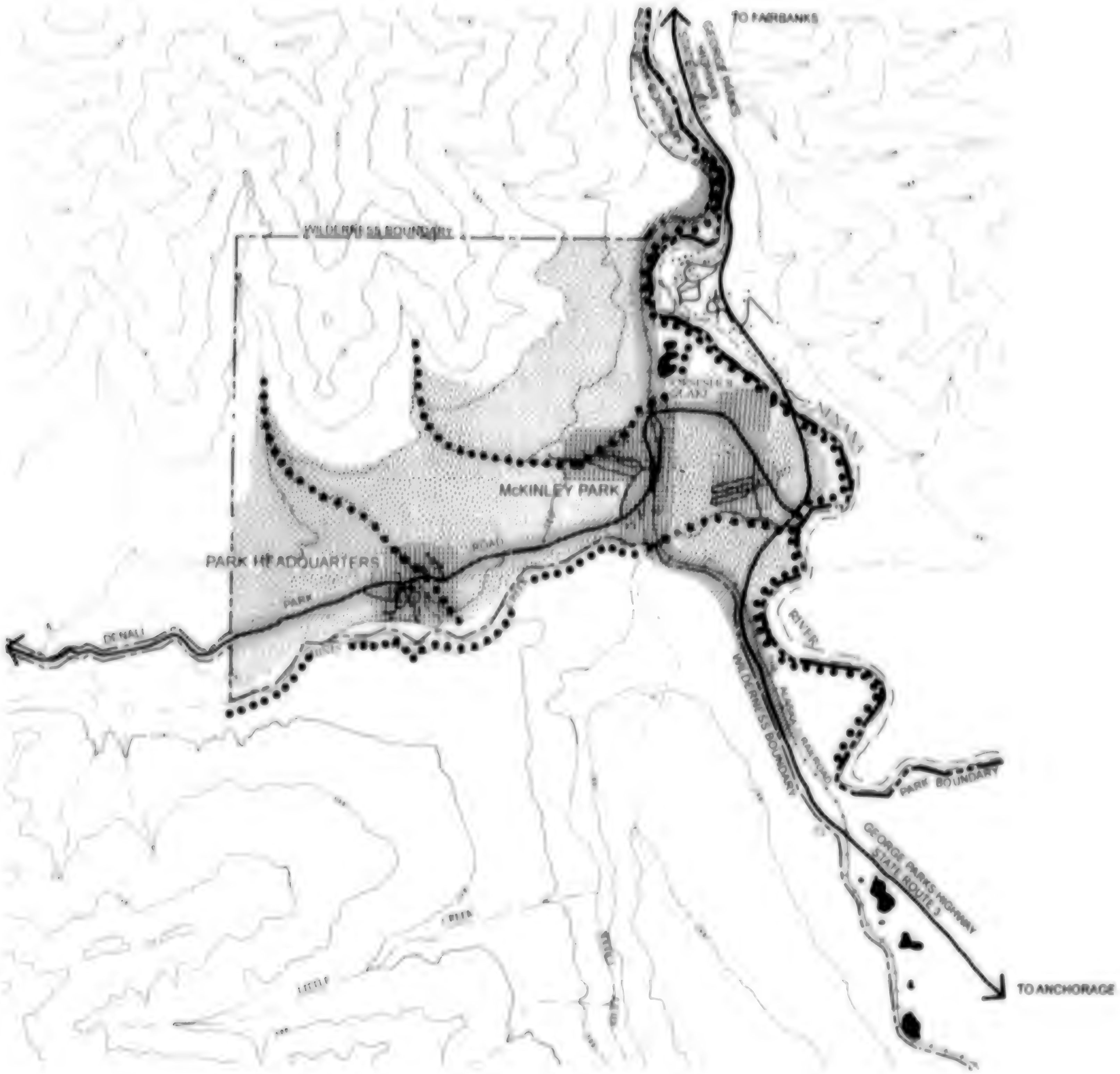
PARK DEVELOPMENT PLANS

The Riley Creek and Denali Park Hotel areas in the park front country have been the subject of numerous planning efforts. The most recent planning document that addresses frontcountry development is the draft *Amendment to the 1983 Development Concept Plan/ Environmental Assessment for the Park Road Corridor and 1987 Addendum*. The proposed development analyzed in this document included a new 150-room hotel and several other facilities in the front country.

The development of a new hotel is not currently being pursued. A new development concept plan (DCP) process for the entire frontcountry of the park began in spring 1993. Because of the small size of the existing hotel and its recently proposed replacement relative to the total lodging capacity of the Denali area, the impact of future decisions regarding the hotel on transportation needs within the park will be minor.

These development plans, along with the park development and management policies stated in the GMP and other NPS planning for Denali, have helped shape the transportation alternatives that are presented in this report.

FRONTCOUNTRY HABITAT AND WILDLIFE ISSUES



LEGEND:

▨	HUMAN ACTIVITY AND CULTURAL RESOURCES
▦	NONCONSOLIDATED DEVELOPMENT CAUSING HABITAT FRAGMENTATION
••••••	RIPARIAN HABITAT AND WILDLIFE MOVEMENT
▒	TAIGA HABITAT AND MOOSE/BEAR USE AREAS

0 1 5 10 MILES

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D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
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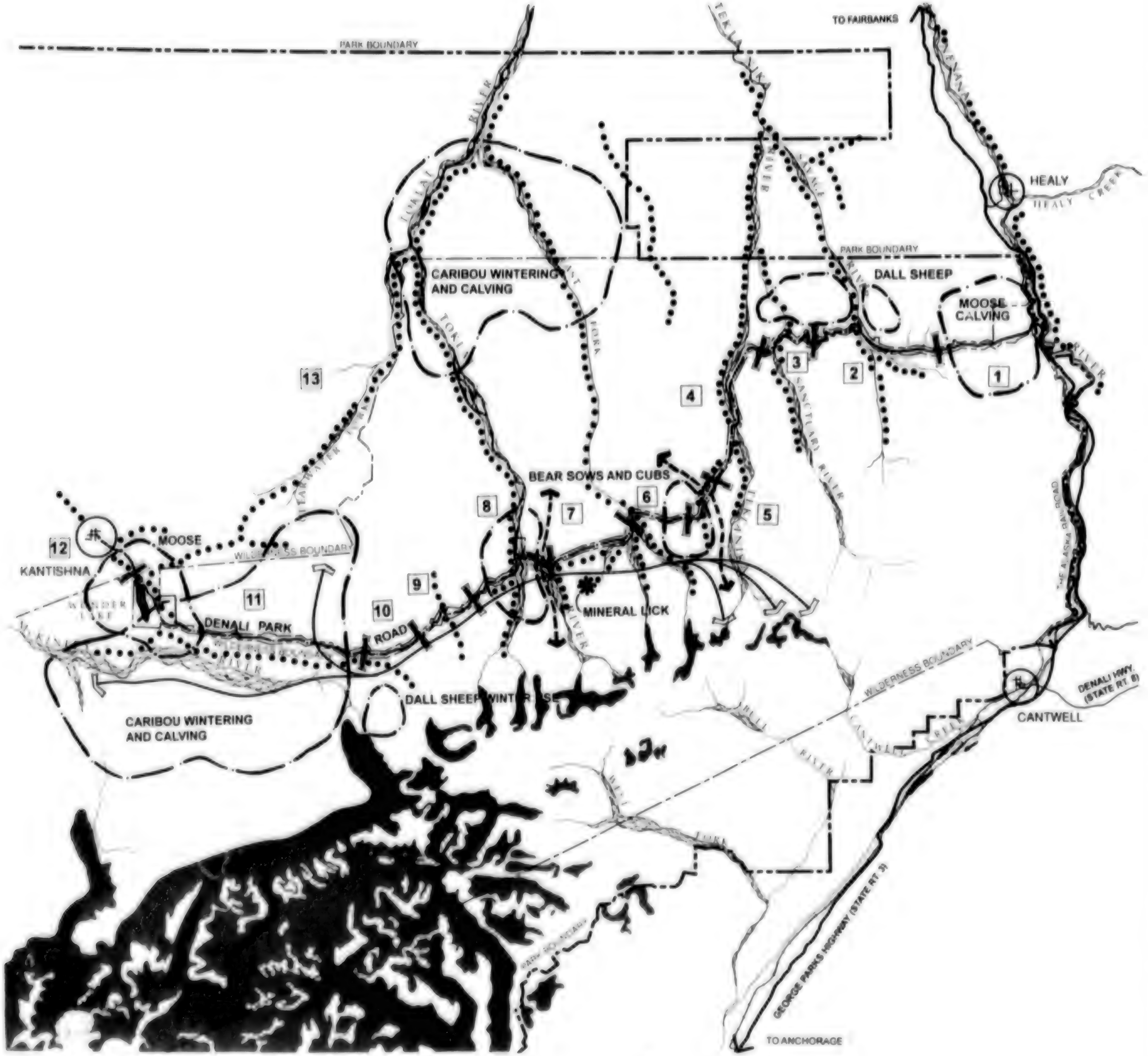

NORTH SLOPE WILDLIFE ISSUES

ROAD SEGMENTS:

1	**Riley Creek/Park Headquarters** MP 1 to MP 8
2	**Savage River Segment** MP 8 to MP 19
3	**Sanctuary River Segment** MP 19 to MP 24
4	**Teklanika River Segment** MP 24 to MP 34
5	**Igloo Creek Segment** MP 34 to MP 39
6	**Sable Pass Segment** MP 39 to MP 43
7	**Polychrome Pass Segment** MP 43 to MP 48
8	**Toklat River Segment** MP 48 to MP 59
9	**Highway/Thorofare Pass Segment** MP 59 to MP 65
10	**Eielson Visitor Center Segment** MP 65 to MP 69
11	**McKinley River to Wonder Lake Segment** MP 69 to MP 88
12	**Kantishna Segment** MP 88 to MP 92
13	**Stampede Road Corridor**

LEGEND:

┼—┼	**DENALI ROAD SEGMENTS**
•••••	**RIPARIAN/RIVER CORRIDOR Wildlife Movement**
- - -➔	**DALL SHEEP MIGRATION**
⇨	**CARIBOU MIGRATION**
◯	**WILDLIFE HIGH-USE AREAS**

NOTE: Bear, moose, Dall sheep, caribou, and wolves are throughout the Denali Road corridor. General distribution for moose is parkwide excluding higher elevations. Moose concentrations are likely in the following areas:

Taiga forests
Major river corridors (Savage, Sanctuary, Teklanika, and Toklat)
Broad wetland areas

0 1 5 10 MILES

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NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
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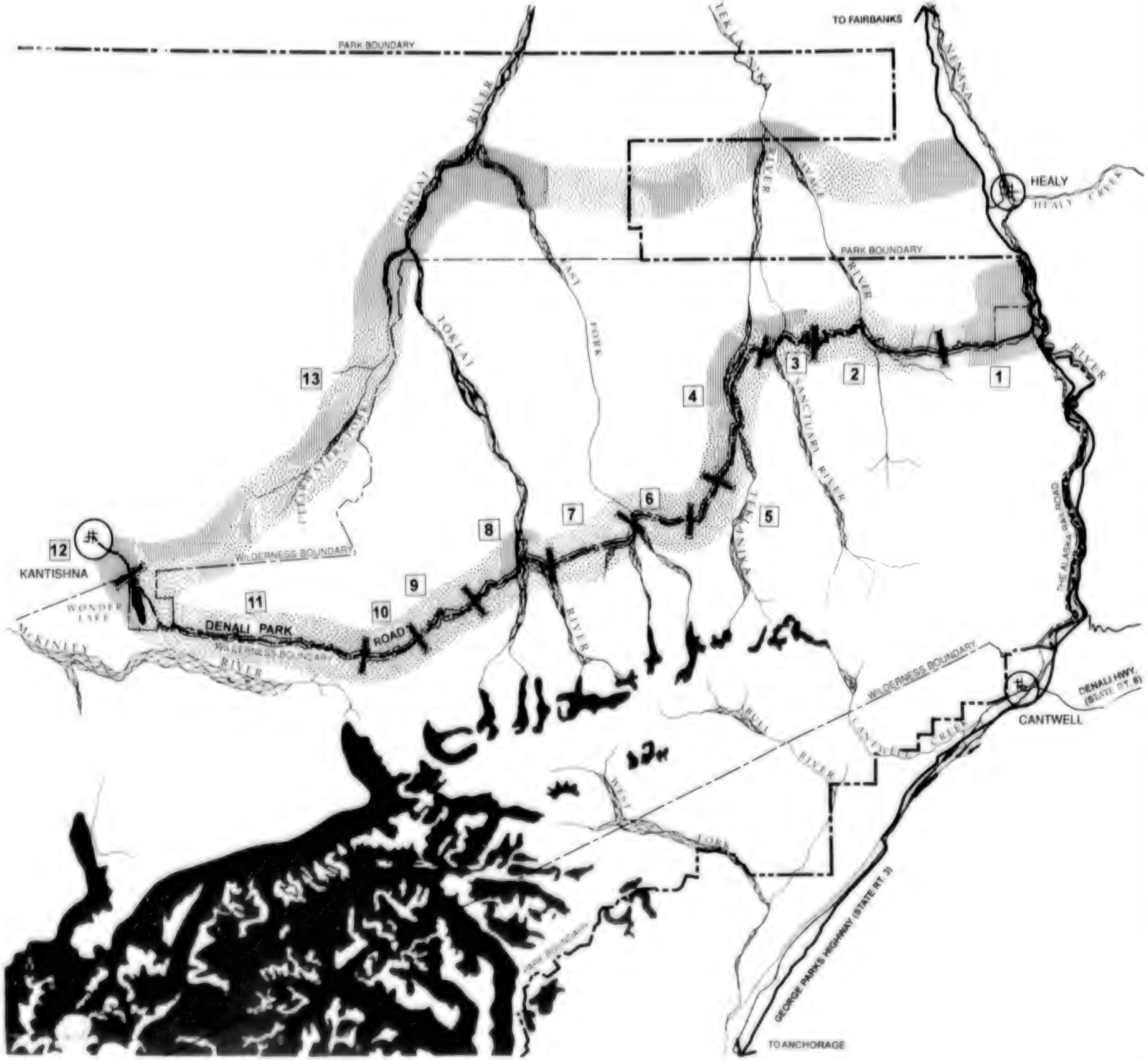

NORTH SLOPE HABITAT TYPES

ROAD SEGMENTS:

1	**Riley Creek/Park Headquarters** MP 1 to MP 8
2	**Savage River Segment** MP 8 to MP 19
3	**Sanctuary River Segment** MP 19 to MP 24
4	**Teklanika River Segment** MP 24 to MP 34
5	**Igloo Creek Segment** MP 34 to MP 39
6	**Sable Pass Segment** MP 39 to MP 43
7	**Polychrome Pass Segment** MP 43 to MP 48
8	**Toklat River Segment** MP 48 to MP 59
9	**Highway/Thorofare Pass Segment** MP 59 to MP 65
10	**Eielson Visitor Center Segment** MP 65 to MP 69
11	**McKinley River to Wonder Lake Segment** MP 69 to MP 88
12	**Kantishna Segment** MP 88 to MP 92
13	**Stampede Road Corridor**

LEGEND:

✕	DENALI ROAD SEGMENTS
░	TUSSOCK/ ALPINE TUNDRA HABITAT
▒	TAIGA/TUNDRA HABITAT
▨	TIAGA/SPRUCE FOREST HABITAT

0 1 5 10 MILES

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NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
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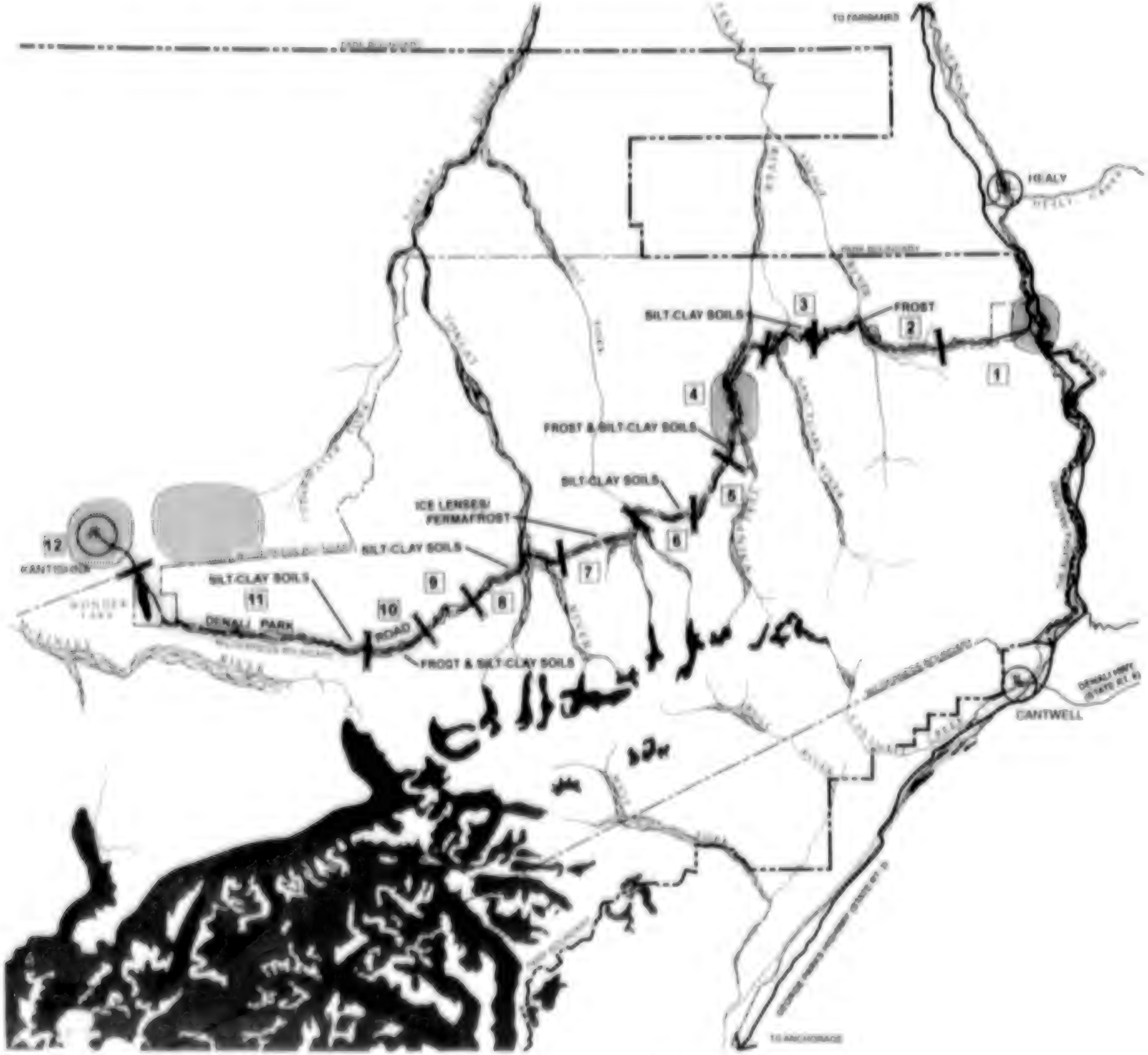

NORTH SLOPE SOILS/ PERMAFROST AND CULTURAL ISSUES

ROAD SEGMENTS:

- 1 Riley Creek/Park Headquarters MP 1 to MP 8
- 2 Savage River Segment MP 8 to MP 19
- 3 Sanctuary River Segment MP 19 to MP 24
- 4 Teklanika River Segment MP 24 to MP 34
- 5 Igloo Creek Segment MP 34 to MP 39
- 6 Sable Pass Segment MP 39 to MP 43
- 7 Polychrome Pass Segment MP 43 to MP 48
- 8 Toklat River Segment MP 48 to MP 50
- 9 Highway/Thorofare Pass Segment MP 50 to MP 65
- 10 Eielson Visitor Center Segment MP 65 to MP 69
- 11 McKinley River to Wonder Lake Segment MP 69 to MP 88
- 12 Kantishna Segment MP 88 to MP 92
- 13 Stampede Road Corridor

LEGEND:

DENALI ROAD SEGMENTS

CULTURAL SITES

LOCATIONS
SILT-CLAY SOILS
FROST
PERMAFROST

0 1 5 10 MILES

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NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY
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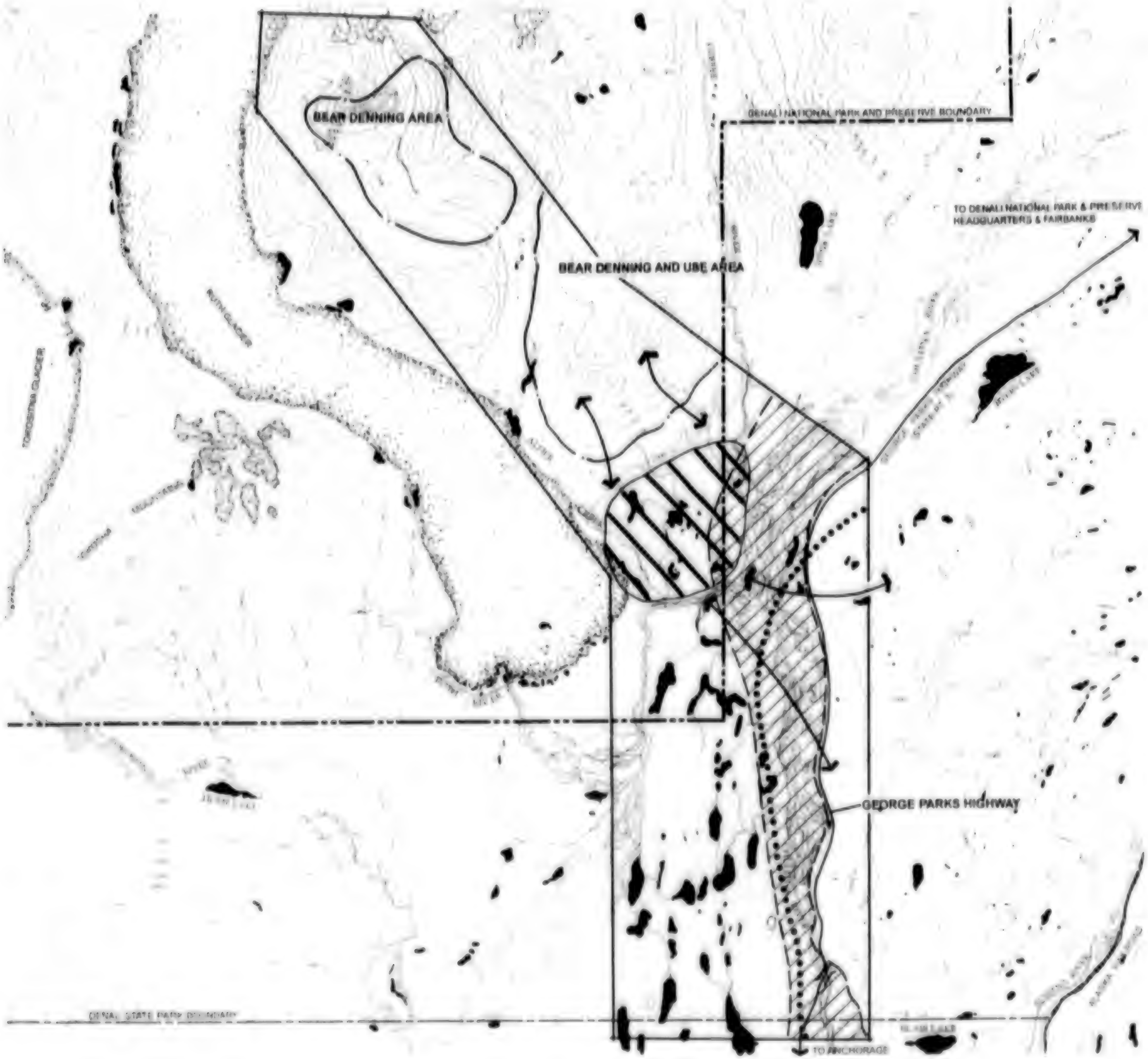
SOUTH SLOPE BEAR AND MOOSE HABITAT


BEAR DENNING AREA
BEAR DENNING AND USE AREA
DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE HEADQUARTERS & FAIRBANKS
GEORGE PARKS HIGHWAY
TOKOSITNA GLACIER
DENALI STATE PARK BOUNDARY
TO ANCHORAGE

LEGEND:

MOOSE SUMMER USE

▨ MOOSE WINTER USE

○ GRIZZLY/BLACK BEAR DENNING

▨ BEAR CONCENTRATION

••••• GRIZZLY/BLACK BEAR USE

→ ANIMAL MOVEMENT PATTERNS

SOURCE: *Denali State Park Master Plan 1989*
NPS Staff

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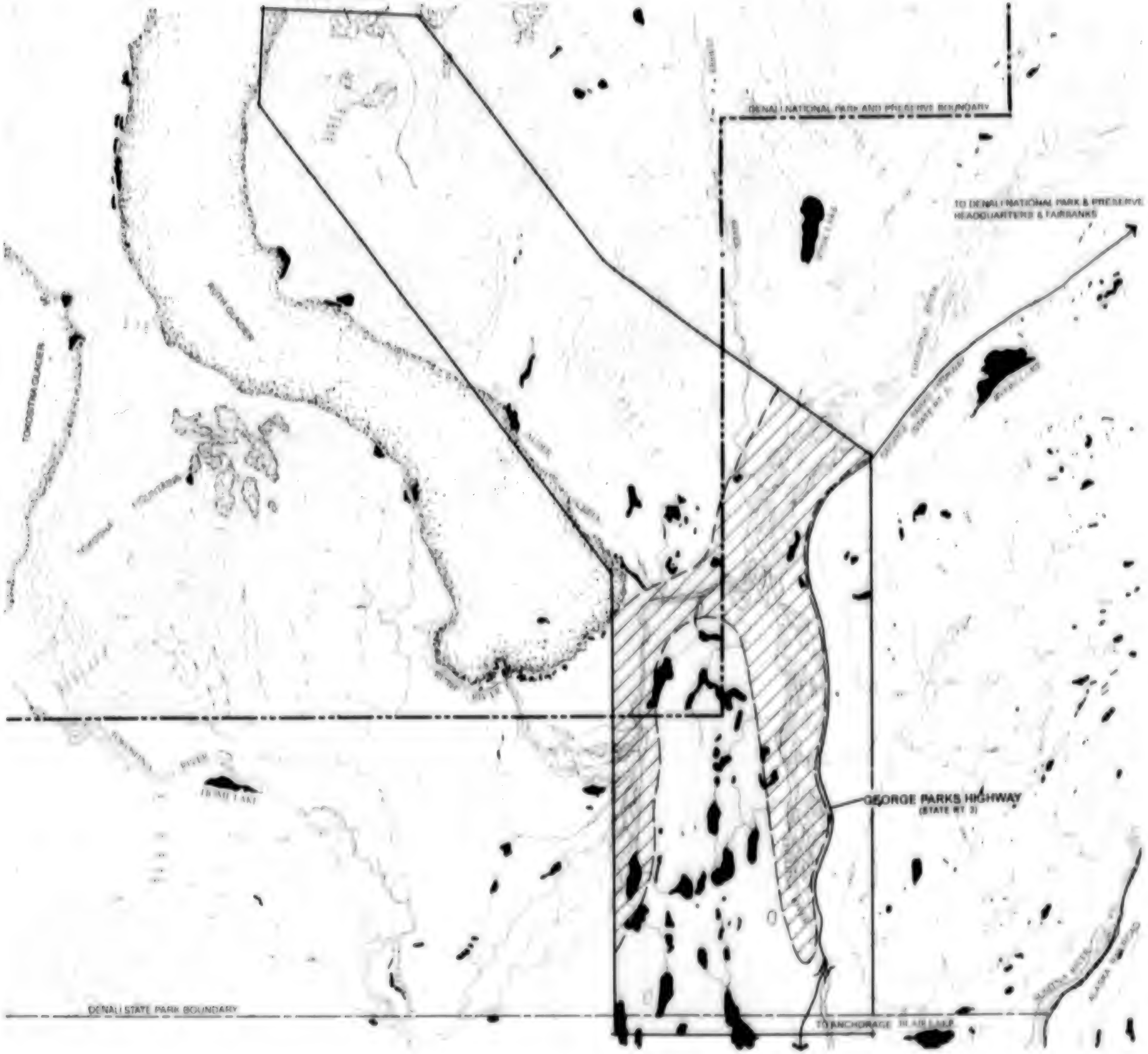
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY


DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE
HEADQUARTERS & FAIRBANKS
GEORGE PARKS HIGHWAY
(STATE RT 3)
DENALI STATE PARK BOUNDARY
TO ANCHORAGE
SUSITNA RIVER
ALASKA RAILROAD

SOUTH SLOPE BIRD AND FISH HABITAT

LEGEND:

▨ RAPTOR CONCENTRATIONS

TRUMPETER SWANS

NOTE: Fish habitat in the area includes
Rainbow Trout
Arctic Grayling
King Salmon
Coho Salmon
Sockeye Salmon
Chum Salmon

SOURCE: Denali State Park Master Plan 1989
NPS Staff

0 1 2 4 MILES

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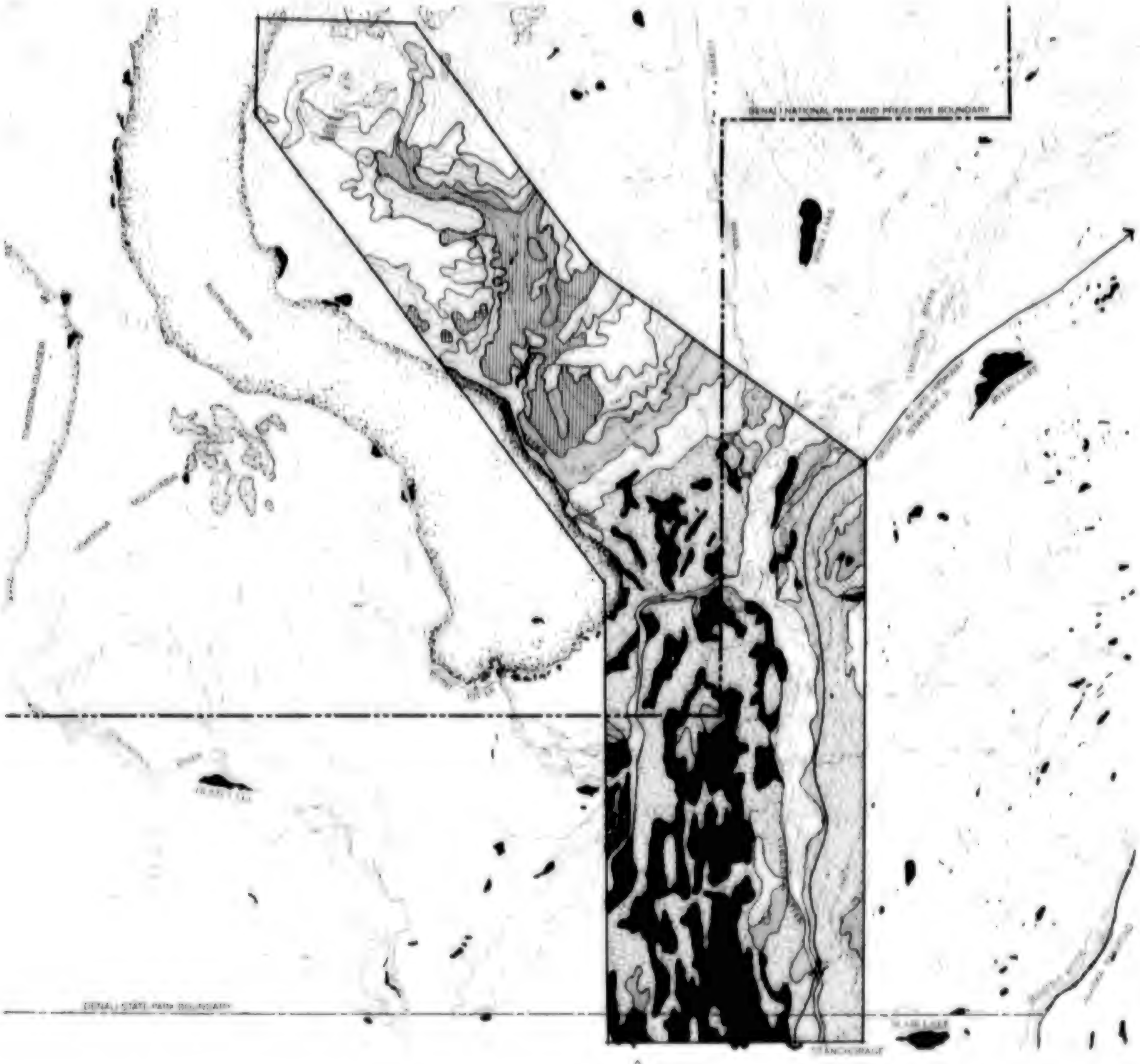
D E N A L I
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

SOUTH SLOPE HABITAT TYPES


DENALI NATIONAL PARK AND PRESERVE BOUNDARY
DENALI STATE PARK BOUNDARY
0 1 2 4 MILES
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LEGEND:

- ☐ BARREN / SNOW / ICE
- ☐ TUNDRA
- ▥ GRASSLAND
- ░ LOW SHRUB
- ☐ DECIDUOUS FOREST
- ░ MIXED FOREST
- ▒ TALL SHRUB
- ■ WETLANDS
- ░ GLACIER

SOURCE: National Park Service G.I.S. Division

D E N A L I
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

ALTERNATIVES DEVELOPMENT AND SCREENING

Transportation system alternatives considered for development at Denali include acquisition of new equipment to increase the visitor carrying capacity of the present VTS services, construction of a new transit guideway along the park road corridor, and development of new means of visitor access outside the existing road corridor. Many combinations of these basic strategies could be pursued, and this study has not considered all of the possible variations. The intent of this study is to provide information on the potential feasibility of a range of options and to identify those alternatives that deserve more detailed study.

CRITERIA FOR DEVELOPMENT AND EVALUATION OF ALTERNATIVES

A set of criteria were developed to guide the development of transportation system alternatives, to focus the initial screening of alternatives to a small set of feasible options, and to compare the feasible alternatives for Denali. The criteria were developed to respond to the study purpose as stated in Intermodal Surface transportation Efficiency Act and to account for the unique transportation problems and environmental conditions at Denali.

Essential Requirements

Each alternative transportation system considered for possible application in Denali was required to meet the following essential requirements:

- Result in no net increase in peak season daily transit vehicle "events" along the park road. A vehicle event is defined as the passage of a single vehicle or train in one direction. The current number of daily vehicle events totals 208[8].
- Allow unrestricted opportunities for unscheduled wildlife viewing stops.
- Maintain the opportunity for unobstructed views of wildlife at close range.
- Provide service at least to Eielson Visitor Center for day-use visitors and access to all campgrounds and backcountry units served by the existing system.
- Accommodate administrative functions, including employee travel and maintenance activities.
- Maintain reasonable access to Kantishna inholdings.
- Be reasonably likely to be constructable within the 300-foot wide wilderness exclusion corridor along the road.[9]
- Employ proven, available technologies for the movement of passengers and be feasible considering power requirements, material availability, and other factors.
- Be capable of operating in a safe manner in the Denali environment.
- Allow passenger boarding at any point along the route.
- Conform to the requirements of the Americans with Disabilities Act.
- Allow unrestricted wildlife movement across the system.
- Include any required expansion of support and visitor facilities.

The evaluation of alternatives that met the essential requirements was organized along the following major topics.

Visitor Transportation and Management

The passenger carrying capacity of the system is the primary criterion under this topic for alternatives using the park road corridor. At the current rate of visitation growth, the number of people traveling to Denali will double in seven to eight years. For planning purposes, a maximum potential demand of 400,000 visitors per season (just under double the 1992 level) was assumed for the park road corridor. Alternatives were developed to accommodate this level of visitation, subject to the essential requirement that transit vehicle events would not increase. Alternatives that would encourage visitor use of the south slope areas of Denali and reduce the visitation pressure along the park road would contribute to visitor management objectives by encouraging visitor use of areas other than the park road corridor. This may accommodate increases in total visitation to Denali.

Visitor Experience

The alternatives were compared with respect to the character of the visitor experience offered and the comfort of passengers using the service. The park road alternatives were not substantially different with respect to viewing opportunities, ease of use, interpretive potential, or noise. Alternatives that would maintain or enhance the wilderness character of the park by fitting into the surroundings and by offering an experience distinct from urban travel were considered to be more desirable than alternatives that were not consistent with the park's basic purpose. This group of criteria includes the impact of the system on views and vistas from points away from its alignment. Alternatives that could address existing problems with uncomfortable seating and exposure to dust received higher scores for visitor experience. The different character of experience associated with alternatives providing access to the south slope was considered in the evaluation of these alternatives' contributions to the visitor experience.

Resource Impacts

Alternatives whose ongoing operation would minimize impacts on the park's significant resources are preferred over those that cause disruption of natural processes. The primary basis for comparing the impact of alternatives on the wildlife in the park road corridor is the number of daily vehicle "events" that are required to transport park visitors at the target visitation level. The construction impacts of alternatives, including noise, vehicular activity, staging area needs, and material requirements also were considered. Alternatives that would provide visitor access and facilities in previously undisturbed areas within the park were carefully evaluated with respect to resource impacts.

Consistency with Planning Goals

Alternatives were assessed for their consistency with park and gateway community goals. The need for cooperative action and other agency involvement was identified for each alternative.

Cost and Cost-effectiveness

Construction, equipment, operation, and maintenance costs were estimated for each of the final alternatives. These costs were compared to visitor volumes to assess the cost-effectiveness of each option. The potential of each alternative to attract funding from sources outside the Park Service also was considered. The capital cost estimates developed in this report have been compiled to reflect total project costs including additions for supervision, contingencies, planning, and design.

Implementation

The impacts of the alternatives on park management, employee housing, and offsite conditions were evaluated. Special implementation requirements, such as environmental compliance activities and wilderness management exemptions, were also assessed.

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PARK ROAD IMPROVEMENTS

Improvements could be made to the park road surface to improve its stability and potentially decrease dust. Seasonal freezing and thawing and unstable permafrost soils would lead to high maintenance costs for a paved road. Because pavement is not permeable, surface runoff could cause greater erosion problems at the edge on a paved roadway than on a gravel road. Also, a paved roadway section would cause a wider area of disturbance than the existing gravel road and a much higher construction cost than simpler stabilization measures. As a result, paving the park road was not considered in conjunction with the VTS alternatives for Denali. The simplest type of stabilization would be to blend angular, well graded, crushed aggregate into the top 6 inches of the existing road structure. This would add strength to the road, but provide flexibility for frost action.

A higher degree of stabilization could be achieved by adding a liquid binder to the top 3 inches of the mixed gravel. The fluid would cement the top layer of the road surface and provide water-proofing. Dust would be greatly reduced, as well.

A preliminary comparative evaluation of several treatment options has been supplied to Denali staff for their consideration (see appendix 5). The choice of bonding material needs to be carefully evaluated with regard to effects on adjacent vegetation and water quality. Test sections could be established to determine if treatment of the road surface is effective and resource impacts are acceptable.

Road stabilization could be undertaken with no change in existing VTS operations and could be combined with the bus alternatives described above. Costs would range from $154,000 per mile for the simple stabilization, to $202,000 per mile if a binding agent were used. The total cost to improve the road between Savage River and Wonder Lake would range from $10.9 million to $14.4 million. Costs include using materials from outside the park with 20% for contingencies.

Measures to reduce dust can be tested in the field.

LONG-RANGE ALTERNATIVES

VTS alternatives considered for development over the long-term included four basic strategies:

- Use higher capacity buses to provide service along existing routes.
- Replace the bus system with a fixed-guideway transit system.
- Supplement the park road with an alternate route to Kantishna. This strategy was included in the study in response to strong interest on the part of the State of Alaska and private groups.
- Develop visitor access on the south slope via an aerial tramway. This strategy responds to requests from outside the Park Service.

Several combinations of the first three options were developed, while south slope access was considered as an independent action.

Higher Capacity Buses

Under the first VTS strategy, two alternatives were developed. The first involved a minor change in the fleet composition to include 52-passenger buses for the entire fleet of NPS and

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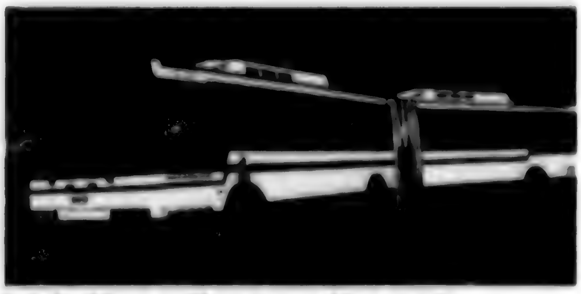
ARA buses. This could be accomplished through NPS purchase of buses similar to those used for the ARA Tours or establishment of a service contract arrangement between ARA and the Park Service.

Double-decker buses may be suited to the geometric constraints of the existing roadway.

The second bus equipment alternative assumed replacement of the current ARA and NPS fleets with high capacity buses. Either articulated or double-decker buses could be used. The geometric constraints of the existing road may make double decker buses more practical than articulated models. Discussions with manufacturers of double decker buses indicate that these large capacity buses have performed well on very rugged mountain roads in Central and South America. Operational tests of candidate vehicles should be made to select the most appropriate model for use in Denali.

Fixed Guideway Transit

A wide range of fixed guideway transit options can be considered for application at Denali. The initial list of options included a diesel-powered cog/adhesion railway similar to systems used in the Swiss Alps, light rail transit (LRT) and group rapid transit (GRT). The GRT class of options could include monorail and other guidance and support technologies. The fixed guideway alternatives were assumed to be located within the 300-foot wide wilderness exclusion corridor along the park road.



Articulated buses could carry more visitors per trip.

Fixed guideway transit could be built along the existing road alignment, closing the road to most or all rubber-tired vehicle traffic, or adjacent to the road. Alternatives constructed adjacent to the road would result in a wider area of disturbance than those confined to the existing road alignment.

Monorail technology was assessed for application at Denali.

Alternate Kantishna Access

The feasibility and cost-effectiveness of providing Kantishna access via the Stampede Road corridor was assessed. Cost estimates were developed for a road and a conventional railroad. Road options were analyzed in combination with bus and fixed-guideway alternatives along the park road.

South Slope Visitor Access

Aerial tramway options to gain access to views of the Ruth Glacier, the Tokosha Mountains, and the Great Gorge were evaluated. Two alternate tramway base locations were studied, along with two upper terminal sites. Access of this type on the south slope may allow growth in overall visitation to Denali to be accommodated while limiting growth in demand for access through the sensitive environment of the park road.

SCREENING OF LONG-RANGE ALTERNATIVES

The initial long-range alternatives were compared to determine if any were infeasible or unreasonable to consider. Order of magnitude cost estimates, implementation difficulties, and general assessments of resource impacts were used to screen out poor options.

The following sections briefly describe those alternatives that did not survive the screening process and the reasons for their elimination. The final alternatives, which were analyzed in detail, are described at the end of this chapter.

Light Rail Transit and Group Rapid Transit

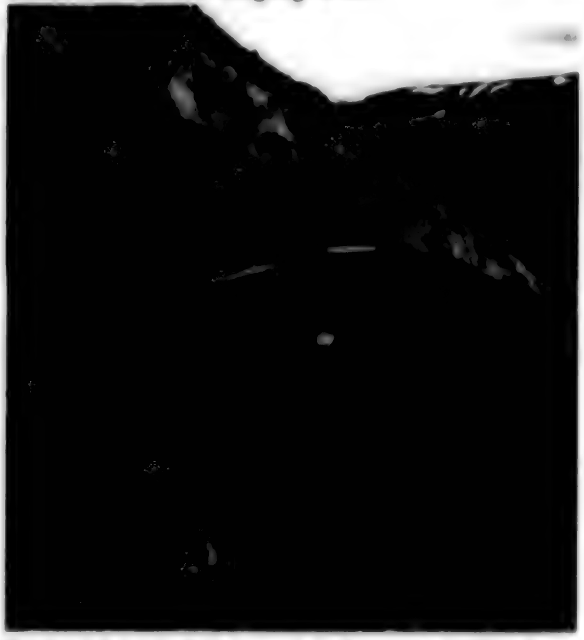
LRT and GRT options were eliminated from detailed consideration due to cost concerns, difficulty in acquiring electric power, the likely need for these alternatives to leave the wilderness exclusion corridor to maintain acceptable grades and curvature, and the intrusion of above ground wires and/or structures into the Denali scenery.

LRT technology would require a substantial electrical power source.

The minimum length of a fixed guideway line to serve travel needs within the park is 51 miles. LRT construction and equipment costs can be expected to range from $8 to $15 million per mile, for a total cost of between $400 and $765 million.

Light rail transit is generally confined to maximum grades of 8 to 10 percent and can only sustain steep grades for short sections. LRT curve radii can approach 100 feet, but speeds are limited and wheel squeal is a problem in tight curves. It is likely that light rail transit would need to leave the wilderness exclusion corridor at Sable and Polychrome passes. It is possible that light rail transit would violate the wilderness boundary in other locations as well. As a result, the extent of habitat disturbance associated with transportation facilities would be increased. The potential to encounter and disturb archeological resources would also be high for this alternative.

The long park road corridor through a wilderness presents special challenges for light rail transit or any option that is electrically powered. Based on the number of vehicles that would be needed to serve the projected demand, approximately 20 megawatts of power would need to be supplied to the system. To deliver this amount of power, a new transmission line would have to be constructed from either Healy or from the Anchorage-Fairbanks tie line over a distance of 7 to 15 miles to reach the park entrance. Additional length would be required to reach an interior staging area.



Grades and curves along the park road present a problem for many transit technologies.

The transmission line would require tree clearing for a probable 100 foot right-of-way, which would result in habitat and wildlife disturbance along its entire length. Construction costs for such a line range from $350,000 to $400,000 per mile. In addition, the visual impact of the line both within and outside the park would be considerable. A modification at the Healy power plant or a substation at the LRT line terminal would also be required to step the voltage down to a level that could be used by the transit system. A substation would cost in the range of $1.5 million.[10]

Most electrified transit systems get their power from several electrical substations located at intervals along the line. Power is supplied from an existing electrical distribution system at several points. Alternating current (AC) is rectified to direct current at each substation, and the transit vehicles are powered by 600- to 750-volt direct current (DC).

At Denali, power would be available only at a single point. The LRT line would have to bring its own power source along the line. Long-distance power lines must carry high voltage alternating current to reduce losses from electrical resistance. The AC power can be rectified on board the vehicles or used directly by AC motors. The feeder cables and contact wire for this type of electrification system would be much heavier and more visually intrusive than the overhead wire system for a typical LRT system in an urban setting. Large insulators would be required between support poles and the wires. The intrusion of the system into the wilderness setting would be substantial and would introduce an industrial image. High-voltage electric power also presents a potential safety hazard for large bird species, such as raptors.

Implementing any GRT technology in Denali, including monorail, would involve difficulties similar to those discussed for light rail transit. System cost could be expected to exceed $1 billion for a GRT system. The guideway and electrification system for group rapid transit would represent a significant hazard to wildlife as well as a barrier to animal movement. As a result, the entire alignment would have to be elevated, with supporting piers every 100 to 150 feet.

The elevated GRT structure would be even more inconsistent with the wilderness purpose of Denali than an overhead system of wires for the LRT option. The elevated guideway would introduce a significant industrial visual element into the landscape.

Rubber-tired technologies could be used to accommodate steeper grades, but curve limitations would still likely result in encroachment into the wilderness area in mountainous sections of the route.

With an elevated alternative such as group rapid transit, passenger access would be restricted to specific station locations. Visitor use would be concentrated, resulting in additional soil and vegetation damage from social trail development. The ability of visitors to experience Denali on their own terms would be reduced, and a more structured experience would be created.

In addition to light rail and group rapid transit, all fixed guideway alternatives located adjacent to, rather than on, the park road alignment were eliminated. The area of disturbed ground associated with transportation would be at least doubled if the existing road was maintained and a new system was built next to the road. Furthermore, in areas of rugged terrain, such as Polychrome Pass, if the road alignment was not used as a location for fixed-guideway transit, it is unlikely that a system could be built to stay within the wilderness exclusion corridor without extreme costs and major changes in the character of the road corridor.

A new 38- to 68-foot cross section of transportation facilities resulting from the construction of a transit line adjacent to the road would significantly disturb existing topography by creating new cut-and-fill slopes. The new corridor might become a physical barrier to wildlife movement, especially in locations with steep slopes. The combination of rail and road vehicle movement could compound wildlife migration interruptions. A substantially greater volume of construction material would be required to provide an entirely new corridor, potentially causing in-park and offsite impacts associated with material extraction and hauling.

Cog Railway

At the current level of conceptual analysis, it appears that an alternative that uses the existing road alignment could be developed using Swiss mountain railway technology. Such an alternative would displace traffic from the road and require that all visitor and administrative traffic travel via rail. Cargo rail cars could be designed to bring shuttles and maintenance vehicles into the park interior. The shuttles and other vehicles would operate on sections of the park road beyond the terminus of the rail system.

The cog railway would consist of two tracks, to allow two-way operation along the entire line. Two tracks would be necessary to allow vehicles to stop at unscheduled locations for wildlife viewing. Along short sections of the park road with inadequate width and rugged terrain, a single track could be constructed. A signalling system would be used to allow rail cars to travel safely along these sections.

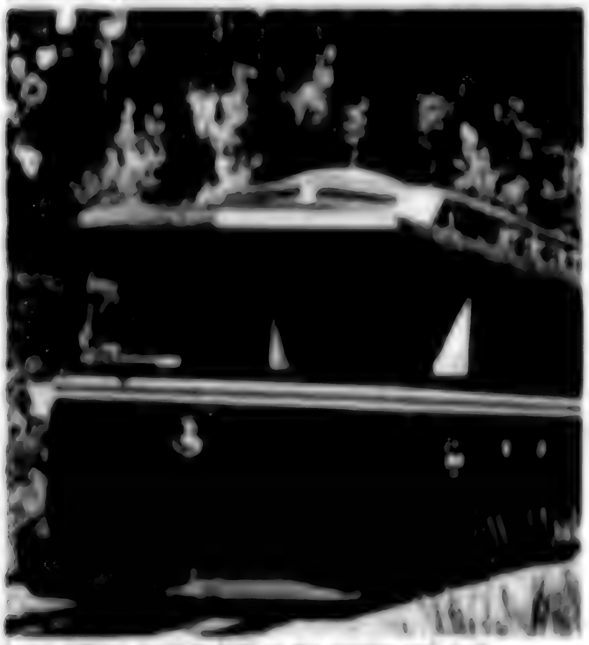
Alternatives which maintain at least a portion of the existing road (for example one lane), along with the alternatives evaluated in this study, could be considered in subsequent engineering studies.

Alternate Kantishna Access

The possible benefits to the park road corridor of a new Kantishna access were evaluated because of interest by parties outside the National Park Service. Road access and the construction of a conventional railroad have been suggested in the Stampede corridor.

The primary advantage of an alternate access to Kantishna would be removing 1,000 to 1,100 annual vehicle trips now bound for Kantishna each season from the park road. If these trips were replaced by shuttle service, about 47,000 additional visitors could be served each season. This would represent a 21% increase in visitor access capacity. This capacity increase would be accompanied by substantial environmental disturbance, however.

Road alternatives along the Stampede alignment could yield marginal additional benefits to the NPS shuttle operation by providing an alternate route for exiting the park as well as reducing park road traffic by eliminating Kantishna traffic. A railroad to Kantishna would ostensibly remove Kantishna-related traffic from the park road, but it would otherwise provide no relief from existing constraints on visitation to the park interior. Because the Stampede route does not traverse areas of wildlife concentration or offer significant opportunities to view appealing terrain, it is not likely that the development of such a facility would relieve visitation pressure along the park road corridor. The only substantive visitor resource served by the route is the excellent view of Mt. McKinley at the route's western end.



A cog railway could be built on the existing park road.

A conventional railroad to Kantishna is estimated to cost about $213 million, including $17 million for equipment and fixed facilities. In addition, the railroad would incur operating costs of between $1.5 and $2.0 million per year. In comparison, a road would cost about $170 million and would have substantially lower operation and maintenance costs. Neither of these estimates include considerable costs for visitor support facilities that would be required along the route and in Kantishna if the Stampede route were developed.

A rail line or roadway to Kantishna along the Stampede Road alignment would have substantial environmental impacts. The railroad option would be approximately $45 million more costly to construct than the road. The railroad option would not provide any potential advantages for VTS travelers on the park road, while a road could be used as a return route for Wonder Lake VTS trips, reducing traffic on the park road. The road option was carried forward for detailed assessment in combination with the VTS alternatives on the park road. The railroad option along the Stampede corridor was eliminated. The cost estimates for the road and railroad options in the Stampede Corridor are documented in appendix 6.

South Slope Aerial Tramway

Two tramway base options were considered for aerial tramway access to an overlook of the Ruth Glacier. One option for the tramway base was at the foot of Alder Point on Denali National Park land. The second option for the tramway base was along the George Parks Highway across the Chulitna River from the first base location. The map on the following page illustrates the access options considered for the tramway.

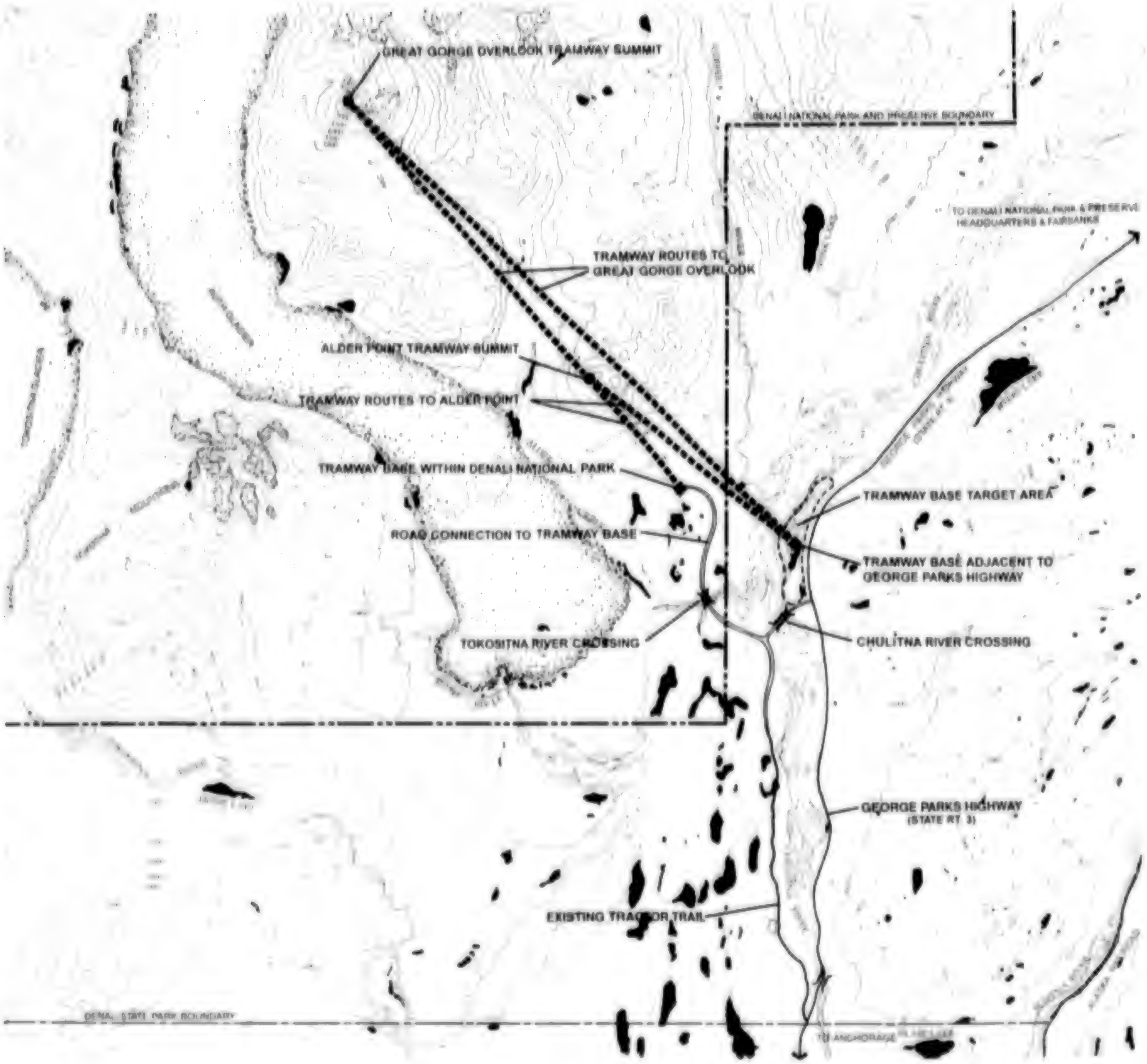
The first tramway base location would be accessible via a bridge over the Chulitna River near the tramway base, or via a road connecting to the George Parks Highway near the point where it crosses over the river approximately 10 miles to the south. An additional bridge crossing the Tokositna River would be required in either case.

This tramway base location has several undesirable characteristics. Foremost among them is its location in prime grizzly bear habitat. The access road alternatives to the site would pass through an area where anadromous fish spawn in freshwater pools, providing a ready and important source of food for the grizzlies.

Both access alternatives for the tramway base within Denali National Park would be difficult to construct and expensive. The Chulitna River crossing near Alder Point would require a very long bridge, crossing the river at a location of braided channels and shifting stream flow. The southern access road follows an established tractor trail through extremely wet ground over a long distance, mostly within Denali State Park.

Because of the problems associated with a tramway base at the foot of Alder Point, an alternate location was identified along the George Parks Highway east of the Chulitna River. With a base at this location, a long access road would not be required. Access for traffic on the highway would be direct, and the tram's

SOUTH SLOPE AERIAL TRAMWAY INITIAL ALTERNATIVES


GREAT GORGE OVERLOOK TRAMWAY SUMMIT
DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE HEADQUARTERS & FAIRBANKS
TRAMWAY ROUTES TO GREAT GORGE OVERLOOK
ALDER POINT TRAMWAY SUMMIT
TRAMWAY ROUTES TO ALDER POINT
TRAMWAY BASE WITHIN DENALI NATIONAL PARK
TRAMWAY BASE TARGET AREA
ROAD CONNECTION TO TRAMWAY BASE
TRAMWAY BASE ADJACENT TO GEORGE PARKS HIGHWAY
TOKOSITNA RIVER CROSSING
CHULITNA RIVER CROSSING
GEORGE PARKS HIGHWAY
(STATE RT. 3)
EXISTING TRACTOR TRAIL
DENALI STATE PARK BOUNDARY
TO ANCHORAGE
0
1
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ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

ability to span long distances could be used to great advantage in bringing visitors across the Chulitna River.

Visitor access on the south slope of the Alaska Range would relieve pressure on the park road corridor

Because of the significant advantages of the alternate base site, tramway options originating at the base of Alder Point were eliminated from detailed consideration.

Two terminal points were considered for the tramway system: Alder Point or an overlook of the Great Gorge to the northwest of Alder Point. Because of the great distances to be covered by the tramways, multiple sections with transfers would be required. The shortest alternative, with an Alder Point terminal, would be 5.5 miles long, requiring two tramway sections with a single transfer point at the midpoint of the route. To reach the Great Gorge overlook, a distance of over 13 miles, four tramway sections would be required. The disruption associated with the three intermediate terminal points required to reach the Great Gorge overlook, and the inconvenience of three transfers makes the longer tramway option impractical. As a result, a single tramway alternative, connecting the George Parks Highway to Alder Point was carried into the final alternatives.

An aerial tramway could provide visitor access to Alder Point for an overlook of Ruth Glacier

FINAL ALTERNATIVES

The alternatives selected for detailed analysis are illustrated on a series of maps at the end of this chapter. They include the following:

Bus Alternatives

The bus alternatives would provide passenger service to Eielson Visitor Center and Wonder Lake along the existing park road. An integrated concessioner and NPS operation was assumed. Both 52-passenger and 72-passenger buses were evaluated. Passenger capacity was determined based on current volumes of NPS and ARA bus trips along the corridor. The impact of adding access to Kantishna along the Stampede Road also was evaluated.

Cog Railway Alternative

A two-track railway, built on the park road alignment and using a combination of cog technology on steep sections and standard adhesion technology along the remainder of the route, was analyzed. Self-propelled, diesel-powered units similar to those operating on Pikes Peak in Colorado were assumed. Terminal points at both Eielson Visitor Center and Wonder Lake were considered. The cog railway alternatives included shuttle bus service from the end of the railway line to Kantishna and, in the case of an Eielson railway terminal, to Wonder Lake. For the Eielson terminal option, the impact of constructing Stampede Road was also analyzed.

For all alternatives, the current number of vehicle events related to NPS and concession tours combined was established as a maximum limit for visitor-related traffic in the park road corridor. For the bus alternatives that included the Stampede Road for access to Kantishna, VTS trips to Wonder Lake were assumed to use the Stampede Road to return to the staging area. As a result, the number of VTS bus trips to Wonder Lake was allowed to double, because each trip resulted in one, rather than two, VTS vehicle events on the park road.

All private traffic to the Kantishna area was assumed to use the Stampede route, if it was available. In this analysis VTS and tour trips on the road were not increased to replace the private vehicle trips displaced to the Stampede Road. If Stampede Road was constructed, tour and VTS vehicle trips could be allowed to increase while maintaining existing levels of vehicle trips along the park road. Approximately 1,000 additional bus trips could be made, carrying 46,000 more passengers (on standard buses), if the private Kantishna trips were replaced by VTS trips.

The cog rail alternatives could serve the target visitation level of 400,000 per year with fewer than the allocated maximum VTS vehicle events. In the evaluation of alternatives, these options received credit for reducing total vehicle events and wildlife impacts.

For this comparison of the alternatives, a new staging area near the Savage River campground has been assumed, based on suggestions by the Denali staff. South of the existing campground, the former site of a lodge and an unused airstrip offers a potential staging area site on previously disturbed ground. The cost of the cog railway alternative is reduced significantly by locating the staging area at Savage, which shortens the length of the rail line by some 14 miles compared to a staging area near the visitor access center.

A major expansion of the parking and staging facilities at the access center or Riley Creek area would cause further fragmentation of the forest habitat in the park front country. A new staging area at Savage River also would have detrimental impacts on the park environment. The selection of Savage River as the staging area for all alternatives analyzed in this study would minimize the construction cost of the cog rail options and to keep the alternatives as consistent as possible. Further study would be required to select the most favorable staging area for any of the alternatives.

Ruth Glacier Tramway

A single tramway system with a base along the George Parks Highway within Denali State Park and a terminal at Alder Point was evaluated. The tramway system would consist of two sections of equal length, totalling 5.5 miles. An intermediate transfer station would be on the slope leading to Alder Point. Alder Point affords views of the Ruth Glacier, the Tokosha Mountains, and of Mt. McKinley in clear weather.

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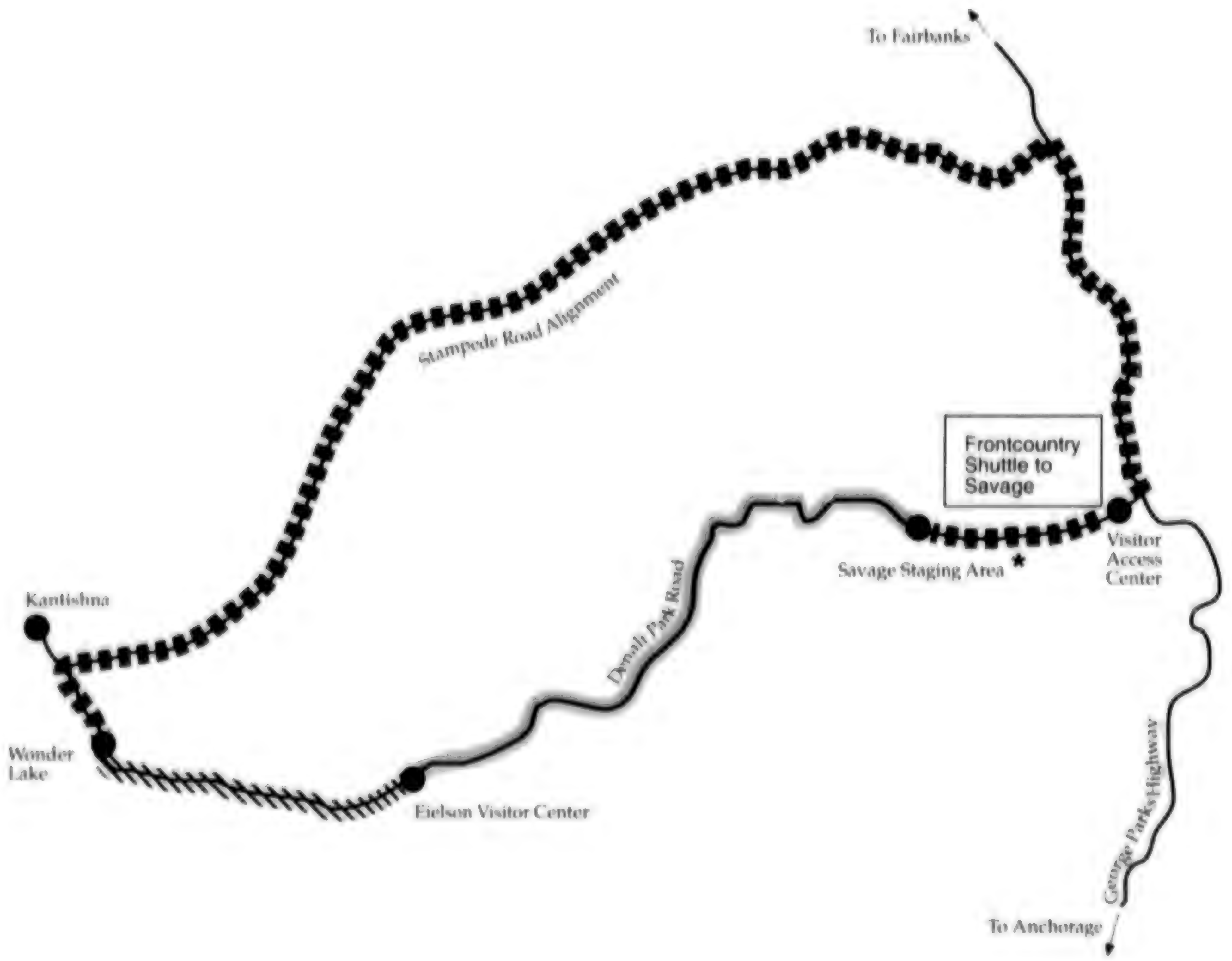

BUS TRANSIT ALTERNATIVES

LEGEND

▒	EIELSON BUS ROUTE
▨	WONDER LAKE BUS ROUTE EXTENSION
■■■■■	RETURN BUS ROUTE VIA STAMPEDE ROAD
*	BUS ALTERNATIVES COULD USE EXPANDED VISITOR ACCESS CENTER FOR STAGING AREA

Not to Scale

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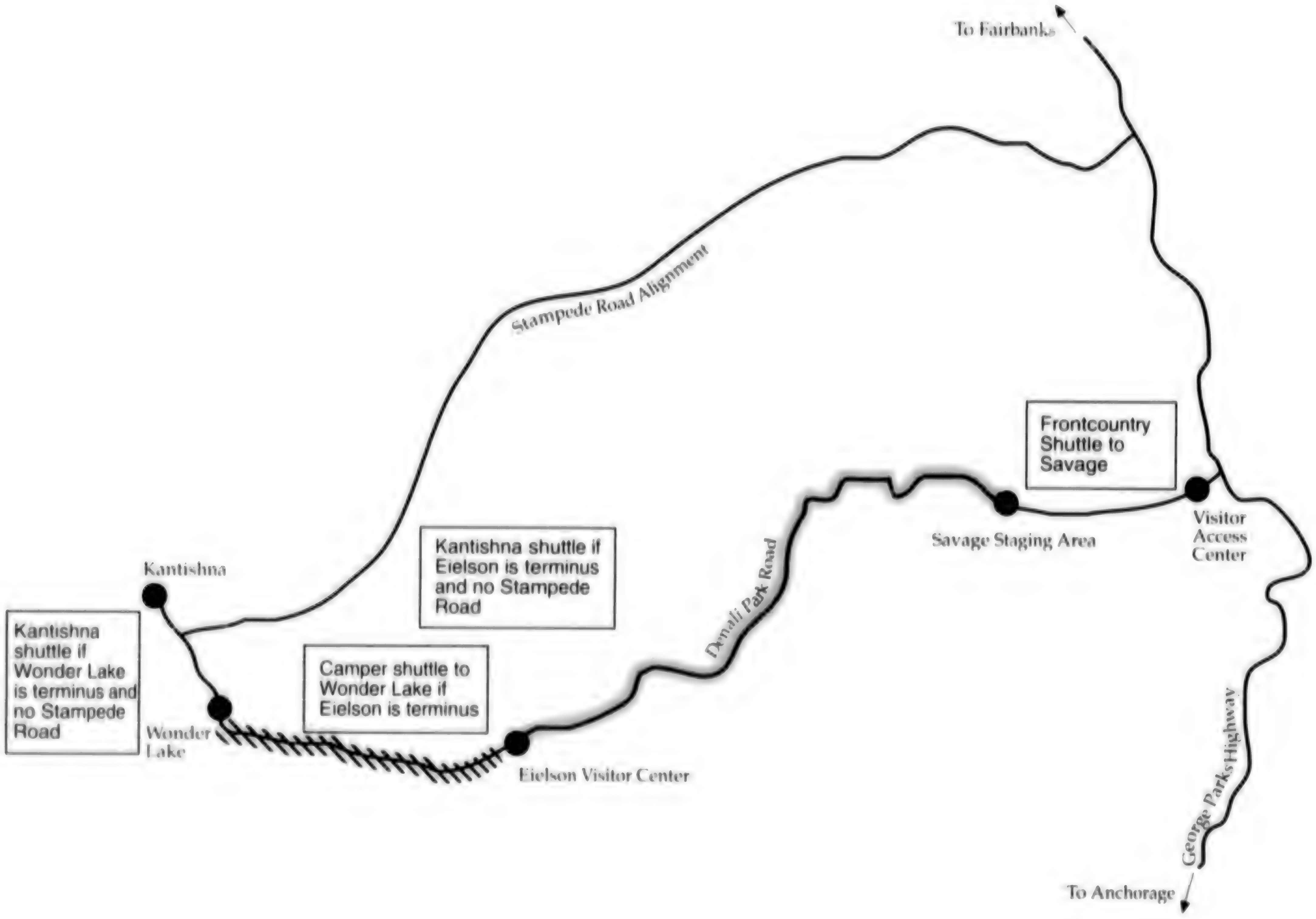
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE [illegible]

COG RAILWAY TRANSIT ALTERNATIVES


To Fairbanks
Stampede Road Alignment
Frontcountry Shuttle to Savage
Kantishna
Kantishna shuttle if Eielson is terminus and no Stampede Road
Savage Staging Area
Visitor Access Center
Kantishna shuttle if Wonder Lake is terminus and no Stampede Road
Camper shuttle to Wonder Lake if Eielson is terminus
Denali Park Road
Wonder Lake
Eielson Visitor Center
George Parks Highway
To Anchorage

LEGEND

▒ EIELSON COG RAIL ROUTE

▨ COG RAIL EXTENSION TO WONDER LAKE

Not to Scale

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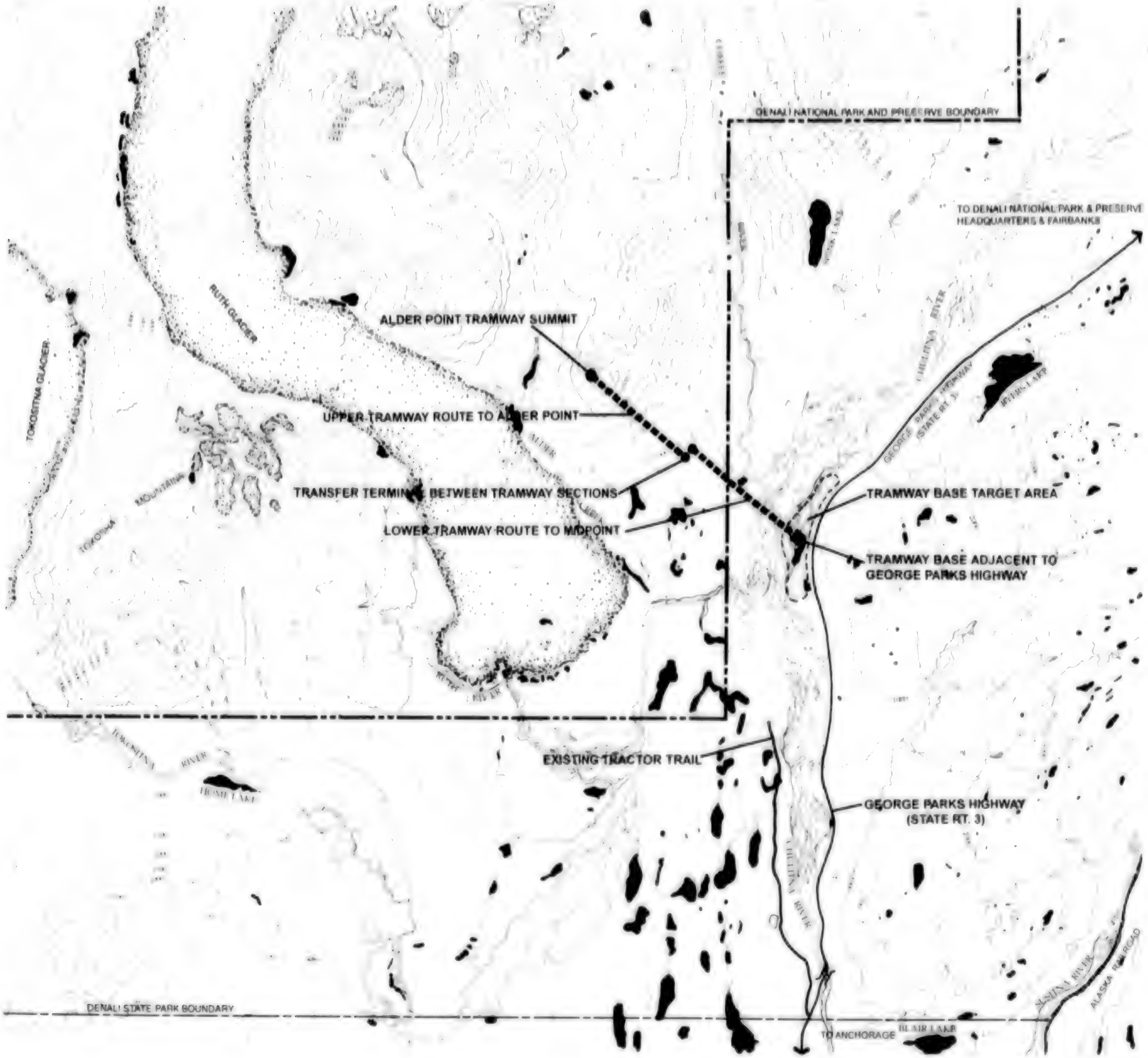
ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE [illegible]

SOUTH SLOPE AERIAL TRAMWAY ALTERNATIVE


DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE HEADQUARTERS & FAIRBANKS
RUTH GLACIER
TOKOSITNA GLACIER
TOKOSITNA MOUNTAINS
ALDER POINT TRAMWAY SUMMIT
UPPER TRAMWAY ROUTE TO ALDER POINT
TRANSFER TERMINAL BETWEEN TRAMWAY SECTIONS
LOWER TRAMWAY ROUTE TO MIDPOINT
CHULITNA RIVER
GEORGE PARKS HIGHWAY (STATE RT. 3)
BYERS LAKE
TRAMWAY BASE TARGET AREA
TRAMWAY BASE ADJACENT TO GEORGE PARKS HIGHWAY
RUTH RIVER
EXISTING TRACTOR TRAIL
TOKOSITNA RIVER
HEWITT LAKE
GEORGE PARKS HIGHWAY (STATE RT. 3)
CHULITNA RIVER
SUSITNA RIVER
ALASKA RAILROAD
DENALI STATE PARK BOUNDARY
TO ANCHORAGE
BLAIR LAKE
0
1
2
4 MILES
N

D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE [illegible]

ALTERNATIVES EVALUATION

The final VTS alternatives for Denali National Park were evaluated against criteria in each of the key evaluation topics described in the previous chapter: visitor transportation and management, visitor experience, resource impacts, consistency with park and other planning goals, cost and cost effectiveness, and implementation constraints or requirements. Recommendations were not made to pursue specific alternatives. The intent of this report is to identify a range of feasible alternatives for VTS service in Denali and to identify the major benefits and impacts of these alternatives. More detailed analysis would be required to select a preferred alternative and to identify all the implications of its implementation.

The following sections provide an overview of the most important results of the evaluation of the final Denali VTS alternatives. Comparisons between the alternatives and with existing conditions are presented for each option. The alternatives evaluation identifies potential environmental impacts that would be fully analyzed later when a preferred option is chosen. A table is provided that summarizes the cost estimates for each alternative.

IMPACTS COMMON TO ALL ALTERNATIVES

While each of the VTS alternatives identified for Denali would have unique benefits and drawbacks, the impacts of the alternatives are similar in some respects. The most important similarity is the impact associated with the greater levels of visitation that they are designed to accommodate. Alternatives that have higher passenger capacities, such as the cog railway, would result in greater visitation-related impacts, but this is a function of their capacity and not a negative characteristic of the transit mode. Additionally, each alternative under evaluation was defined using the same vehicle operating speed to be consistent with the existing services and to maintain the same standard of viewing experience.

Implementing any of the transportation system alternatives would lead to varying degrees of increased visitation which would result in the need to expand visitor facilities (such as rest areas and passenger loading areas). There may be an increased potential for social trail development in areas of concentrated use, the need to increase maintenance activities in areas of concentrated use, and an overall increase in vehicular traffic and visitor activity in the frontcountry. Formalized trails may need to be developed in some locations to avoid soil compaction and damage to vegetation. A careful evaluation of the broader issues associated with increased visitation will need to be made before a final selection of a preferred strategy for visitor transportation in Denali. The transportation system should respond to the need for visitor use management and should be consistent with the overall carrying capacity of the park.

Impacts from a staging area at Savage River campground would be very similar for bus and cog rail alternatives and are treated as such for comparing the alternatives. With the presence of Savage River staging area, localized resource impacts would be greater for each alternative compared to the existing system. A Savage River staging area with parking, storage and associated visitor services would potentially increase disturbance to habitat, wildlife and archaeological resources. Erosion and sedimentation into the clear-running Savage River system from construction, wildlife disturbance from additional human activity, and habitat disturbance from social trail development could potentially occur. In addition, impacts from unlimited frontcountry visitor access would probably extend out to the Savage staging area. Campers in the Savage River campground could be disturbed by the noise and activity levels associated with visitor vehicles and VTS operations in the staging area.

Each alternative will result in more visitation and the need to manage visitor movements.

Each of the alternatives could avoid these impacts by providing one or more frontcountry staging areas in place of Savage River. The cost of locating a staging area in the frontcountry would be greater for the cog rail alternatives than for the bus alternatives. Further detailed study will be necessary to make a final selection of a staging area for any improved system for transporting visitors.

EVALUATION OF ALTERNATIVES

The major features of each alternative are illustrated on maps appearing at the end of this chapter. The maps include typical cross sections of the options, definitions of the numbers of VTS vehicles required, the number of vehicle events on the park road, the accumulations of passengers at key locations, and the associated needs for visitor and transportation facilities. The maps describe the following information and alternatives.

- Existing conditions, providing a basis for comparing the alternatives

Bus Alternatives

- 52-passenger buses operating on the park road
- 52-passenger buses operating on the park road and Stampede Road
- 72-passenger buses operating on the park road
- 72-passenger buses operating on the park road and Stampede Road

Cog Railway Alternatives

- A cog railway constructed on the park road to Eielson Visitor Center
- A cog railway constructed on the park road to Eielson Visitor Center with Stampede Road
- A cog railway constructed on the park road to Wonder Lake

Aerial Tramway Alternative

- An aerial tramway from the George Parks Highway to Alder Point

Summary evaluation charts are provided for each group of alternatives, showing the results of the alternatives evaluation. These charts appear after each group of maps showing the alternatives. The following discussion, organized by the major evaluation categories discussed in the previous chapter, highlights the most important findings of the evaluation of alternatives.

Alternatives that involve the Stampede Road would have much greater impacts than others. The Stampede Road alignment would sever pristine habitat, segmenting vast undisturbed areas of the park ecosystem. The road could double the amount of human development and visitor activity in the northern part of the Denali ecosystem. The Stampede Road impacts would be substantially greater than those along the park road because Stampede Road would be open to unlimited vehicular access.

The Stampede Road alignment passes through caribou wintering and calving grounds along the Toklat River and traverses several areas of taiga/spruce forest, used by moose for calving. The presence of large numbers of vehicles and visitors who can be expected to approach wildlife on foot would cause disruptions far beyond any now present in the park.

Other impacts of using the Stampede Road alignment include construction disturbance to habitat and wildlife at numerous river crossings and disturbance from development sites along the new corridor. There would be increased visitor activity and habitat damage in Kantishna and at nearby archaeologic and historic resources, and there would be disturbance in and outside the park from developing material borrow sites and importing construction materials. The majority of the Stampede Road route lies within lands proposed for designation as wilderness. NPS policy requires that proposed wilderness lands be managed as if they were designated wilderness.

Visitor Transportation and Management

The most important difference between the alternatives is their visitor carrying capacity. The cog rail alternatives, the large bus with Stampede Road, and the Ruth Glacier tramway are the only options that can carry the assumed demand of 4,000 daily visitors while conforming to the established vehicle trip levels. Cog rail vehicles can be coupled together to obtain higher capacities while retaining the allocated number of vehicle trips. The cog rail alternatives can carry 4,000 daily visitors with approximately 20% fewer VTS trips than the large bus option.

A single mode of travel between Savage River and Eielson would be used for all trips with a rail alternative. This could reduce total vehicle events on the park road by as much as 75%. The Ruth Glacier tramway would serve up to 2,400 visitors per day in addition to the 2,325 visitors who can be served by the current transportation system and tour operations on the park road. The tramway might attract higher visitation levels than the other alternatives due to the new and different experience it would offer. The period of operation in the spring and fall might be expanded because of the aerial nature of the tram and the milder climate on the south slope.

Each alternative offers a comparable level of accessibility, trip time and reliability when the system is fully operational. Limited access for park visitors would be a key factor during the construction of a rail system. Access could be provided to interim locations as construction occurs. Any rail option would also require some transfers to a shuttle system for campers and/or Kantishna visitors, depending on the system terminal or the existence of Stampede Road. Alternatives that include Stampede Road would offer separate access for Kantishna visitors and alternate access for some backcountry users.

Under any of the bus alternatives, visitor accumulations could be kept relatively consistent with existing conditions at rest stop locations. Rest stops would have much higher accumulations with a rail alternative if they were used by travelers going into and out of the park simultaneously. Any option that provides increased daily visitation capabilities could increase crowding significantly at the staging area and Eielson Visitor Center. Table 5 shows a comparison of estimated daily visitor accumulations at key activity locations.

The Ruth Glacier tramway option opens additional areas of the park to visitor use. Providing a tramway system would support the GMP strategy of increasing south slope access and could potentially relieve the park road corridor of pressure for added visitation. The daily capacity of the tramway system would allow Denali visitation to double without any additional visitor use along the park road.

Table 5: Average Number of Visitors Present at Activity Areas on Peak Use Days

	Existing[a]	Std. Bus, No Stampede Rd.	Std. Bus, With Stampede Rd.	Large Bus, No Stampede Rd.	Large Bus, With Stampede Rd.	Cog Rail to Eielson, No Stampede Rd.	Cog Rail to Eielson, With Stampede Rd.	Cog Rail to Wonder Lake, No Stampede Rd.
Savage Staging Area	117	230	230	320	320	582	582	388
Teklanika Rest Stop (2-Way)	282	208	208	288	288	432	432	216
Poly./Toklat Rest Stops (1-way)	238	104	156	216	216	216	216	216
Eielson Visitor Center	308	416	520	648	720	648	648	864
Wonder Lake Rest Stop	44	52	52	72	72	Not Applicable	Not Applicable	216

Source: BRW, Inc.

a. Staging occurs at visitor access center.

Visitor Experience

The evaluation of visitor experience assesses differences between the alternatives for system users and nonusers. The alternatives do not differ dramatically, but where they do, it may often be a result of individual preference.

Views of scenery and wildlife would be improved with any of the vehicle types under consideration. Buses could be modified to provide greater glass area, while most existing cog rail vehicles are designed with viewing opportunities in mind. Vehicles also could be colored to blend in to their surroundings. The cog rail alternatives would eliminate dust, resulting in enhanced views. Images following the alternative illustration maps and evaluation charts illustrate existing buses and the potential appearance of a cog rail system on Polychrome Pass.

While a cog rail system might enhance the mountain experience, bus alternatives would offer the same basic character as today's operation. Existing unscheduled viewing and access capabilities could be maintained with any of the options. Cog rail vehicles would offer the greatest opportunity for improving visitor comfort.

Visitor enjoyment of the park would be disrupted during construction of the cog rail alternatives. Access along the park road would be impossible during construction. The system could be opened in stages to allow access to portions of the park interior as construction proceeded.

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Bus options would provide some added visitor comfort, but the cog rail option would be the most comfortable.

The Ruth Glacier tramway would provide a dramatic means of interpreting unique park resources that are not well known or appreciated. The ride on the tramway and the views would be extraordinary from a visitor standpoint, providing an experience that would rival the trip along the park road as a once-in-a-lifetime experience.

Resource Impacts

Resource impacts of each alternative have been analyzed by comparing the degree to which they vary from existing conditions. The most apparent disturbances are discussed below; a more detailed list for each alternative is included in appendix 4.

The significant reduction in vehicle events associated with a cog rail alternative would decrease wildlife migration disturbance along the park road corridor. Either bus option that includes Stampede Road would divert Kantishna traffic from the wilderness corridor, resulting in a minor benefit to wildlife movement.

Staging areas and maintenance facilities would encroach into undisturbed land. Space requirements range from 13 to 20 acres, with the smallest scale cog rail option requiring a minimum of 18 acres. A cog rail option could result in minor wilderness encroachment along the road in areas of rugged terrain, but is likely to fit into roadway alignment along most of its length. A small shuttle service facility (including fuel storage) would be required in the Eielson to Wonder Lake segment when considering a cog rail terminal at Eielson Visitor Center.

Each alternative that significantly increases daily visitor levels will increase activity at Eielson Visitor Center, which could cause habitat disturbance due to an increase in the formation of social trails. Wildlife behavior could be disrupted by the higher levels of visitor activity and noise associated with more visitation. Wildlife and habitat disturbance could be reduced by using more than one system terminal for lunch or mid-point activities.

Construction along Stampede Road or the park road could disrupt wildlife.

A key difference between the bus and rail alternatives is the long term effect to the road edge habitat. The rail options offer the potential for healing of the road edge by eliminating grading requirements and dust. Road maintenance for bus traffic will continue to deteriorate the road edge habitat and require a constant gravel source. Alternatives using larger buses with higher axle loads could increase the need for road repairs.

The most significant construction impacts are associated with the cog railway and Stampede Road options. At least two seasons of wildlife disturbance and displacement would be likely. There may be some Native American concerns because of historical occupation of lands by the Tanana people along the Stampede Road Corridor. Water quality impacts, noise, equipment emissions and dust would occur. Construction could also be slowed by work stoppages to avoid affecting wildlife migration, discovery of archeological sites and artifacts, and other environmental concerns. Impacts from gravel excavation activities and construction crew housing are also large-scale issues linked to these alternatives.

Opening the Stampede corridor to visitor traffic would disturb pristine habitat and segment the park with an additional transportation corridor, bounding the Wyoming Hills range on the north and the south with human development. The Stampede corridor would potentially affect caribou wintering and calving habitat, raptor habitat, and primary moose habitat and introduce potential disturbance to new, non-habituated wildlife populations. New access would require new staffing levels for resource protection and visitor use management. Impacts on natural vegetation from opening the Stampede corridor would include: influences of imported material containing non-native biota, disturbance of wet tundra and riparian habitat, and effects on the hydrology, water quality and aquatic habitat of five major river corridors (including the clear-running Savage River, Clearwater, and Moose Creek systems).

The development of a tramway system on the south slope would introduce human influence in a presently undisturbed area. Construction of a visitor contact area, comfort stations, parking facilities and perhaps other support facilities at the base of the tramway would produce long-term impacts. Minor habitat and soils disturbance would be caused during the construction of the system, especially at tramway tower locations and at the base, transfer point, and terminal. These effects could be mitigated through well-managed construction techniques and delivery of materials via helicopter.

The potential for soil compaction and vegetation damage would exist at the base and terminal points. The tramway alternative would have little to no effect on wildlife movements because visitors and the system are effectively isolated from their surroundings. Minimal noise would be generated by the system, and any noise would be limited to the immediate area of the base, transfer and terminal points. Disruption of bird flights in the area of the tramway system is possible, though not likely.

Consistency with Park Service and Regional Planning Goals

For any of the alternatives to operate at maximum efficiency, a reservation system would be extremely valuable. Reservations would help to spread daily visitor levels more evenly throughout the operating season and maximize the system capacity. A reservation system would also limit the need for additional overnight accommodations by shortening average stays in the park. An additional management issue would be a clarification of NPS policies regarding user fees. For a system to be self funding, annualized costs per visitor could range from $17 to $19 for the most economical bus alternatives, to $62 to $80 for the most expensive rail alternative (excluding Stampede Road). Exclusive operation by a concessioner is an option, but a practical access fee must be maintained if transit is the only means of entry. A turnkey operation would provide a potential means of financing the high cost of the cog rail or aerial tramway options.

Each of the road corridor alternatives involve trade-offs in providing reasonable access to the Kantishna area. The rail alternatives without Stampede Road would provide more control over Kantishna access. Any alternative including Stampede Road will stimulate major development pressures in Kantishna and create a large new area to patrol for law enforcement and resource protection. Illegal hunting would be a

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major concern, because of the large area of the park that would be open to unrestricted access.

The aerial tramway alternative would open a new area of the park to visitor use and would require an increase in staff resources for visitor management and protection as well as interpretation. Close cooperation between the Park Service and the state would be required to implement and manage the tramway system and its base facilities within Denali State Park.

Offsite impacts of the alternatives include a major increase in hotel demand, primarily associated with the rail alternatives, large bus options and the aerial tram. Gravel source and delivery requirements would also be a significant off-site impact for the rail and Stampede Road alternatives. Operation of the tramway system would require coordination with the utility companies and with the state to provide the necessary electric power. A power line would be required, resulting in visual impacts and habitat disruption outside the park and preserve.

Cost and Cost-effectiveness

The differences in capital costs among the alternatives is significant. The high-end capital cost for the most economical cog rail alternative is almost 10 times the high-end cost for the large bus alternative (excluding Stampede Road). The capital cost of the aerial tramway falls between the bus and cog rail options. The annual operating and maintenance costs are typically lower for the cog rail and tramway alternatives due to reduced staff requirements associated with a smaller vehicle fleet. The information in table 6 illustrates the range of costs estimated for each of the final alternatives. A more detailed summary of the cost estimates is included in appendix 2.

Implementation

The most significant compliance issues associated with the bus alternatives would be the need to complete a National Environmental Policy Act (NEPA) compliance document for a Savage River staging area. A comprehensive environmental impact statement (EIS) would be required for constructing Stampede Road. Construction of a road along the Stampede alignment also would require an exemption to NPS management policies mandating that proposed wilderness areas be managed as congressionally designated wilderness.

Related facilities or improvements necessary along the park road would likely require additional environmental documentation. Gravel excavation would be the primary item of assessment for ancillary facilities related to any alternative. Cog rail alternatives and the Ruth Glacier tramway would require very comprehensive EIS and design efforts due to the extreme sensitivity of the park's natural habitat, the historic significance of the park road, and the dramatic change in transportation character associated with these alternatives. The environmental impact statement for the cog railway system would also need to address the issue of disrupting park access during construction. The upper end of the tramway alternative enters land proposed as wilderness in 1988. Construction of this alternative would require an exemption from NPS wilderness management policies.

Employee requirements will be unique for each of the alternatives. There will be non-transportation related law enforcement and interpretive staff required for higher visitation levels to provide interpretation and routine assistance duties. Stampede Road options would generate a new management area and a major impact on ranger staff needs.

Transportation staff needs will typically be greater for bus options due to the larger number of vehicles being used and increased road maintenance responsibilities. The need for Stampede Road maintenance could essentially double road maintenance demands. An employee requirement unique to the cog rail and tramway alternatives would be the need for specialized labor trained to operate and maintain these unique systems.

Table 6: Denali Transit Alternative Cost Estimates

	Standard Bus, No Stampede Rd.	Standard Bus, With Stampede Rd.	Large Bus, No Stampede Rd.	Large Bus, With Stampede Rd.	Cog Rail to Eielson, No Stampede Rd.	Cog Rail to Eielson, With Stampede Rd.	Cog Rail to Wonder Lake, No Stampede Rd.	Aerial Tram Parks Hwy to Alder Pt
Construction and Equipment	$21.4 million	$194.0 million	$36.7 million	$209.3 million	$314.5 million	$482.4 million	$413.5 million	$87.2 million
Annual Operating and Maintenance	$3.2 million	$4.2 million	$3.4 million	$4.2 million	$2.7 million	$3.1 million	$3.1 million	$667 thousand
Annual Cost per Visitor	$18.61	$59.38	$17.62	$49.34	$61.66	$94.72	$80.08	$28.88

Source: HRW, Inc.; Tramway cost estimates provided by CTEC, Inc., USA representatives for Garaventa Tramways, Salt Lake City Utah

Note: Equipment total costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages are applied.
Facility total costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.
Annual cost per visitor is based on current 111-day visitation season.

EVALUATION SUMMARY

Each of the alternatives evaluated offers advantages and disadvantages. The selection of a preferred approach will depend on a policy-level evaluation of the tradeoffs among the alternatives. A significant consideration in the choice among alternatives is the level of funding that may be expected to be available in the near term and over a longer timeframe. The cog railroad alternative requires a level of investment that is far beyond the current resources of Denali National Park and Preserve and the National Park Service.

Relative to the other available options, the development of a new access route into the park along the Stampede Road would yield little benefit in terms of visitor access to the primary resources of the park, would be costly to construct and maintain, and would result in unacceptable potential for habitat damage and segmentation and disturbance to wildlife. There would be increased needs for resource protection and visitor use management.

The existing tour and shuttle services can be improved incremental by further streamlining the operation and by upgrading the equipment over time. Larger buses offer the potential to significantly increase visitor carrying capacity at a relatively low cost. Operational tests of larger vehicles and more in-depth study of the structural capacity of the road should be undertaken prior to the use of such vehicles.

The cog railway technology offers some real advantages for the long term. Visitor capacity can be adjusted by increasing the fleet of rail vehicles with little risk of exceeding the established vehicle traffic limits in the park road corridor. Implementing a cog rail system would result in a substantial reduction in wildlife and habitat disruption by reducing vehicle events along the park road.

The cost of a cog rail system would be substantial, as would the impacts of construction. Once in place, the cog rail system would offer cost-effective visitor transportation and a much higher level of visitor comfort compared to travel by bus. The annualized cost per passenger of $62 for a cog railway to Eielson Visitor Center may be compared to the current fare for ARA bus service into the park of $45. However, users of the NPS shuttle system now pay only the $3.00 park entry fee. The cost of access to the park interior should be evaluated in the context of the overall cost of vacation travel to Alaska.

The development an aerial tramway for visitor access to the south slope and to views of the spectacular glaciers and rugged foothills in that portion of the park provides an alternative to increasing visitation in the park road corridor. Isolated areas of disturbance would result from the installation of a tramway system, particularly at support tower locations and at the tramway base and terminal sites.

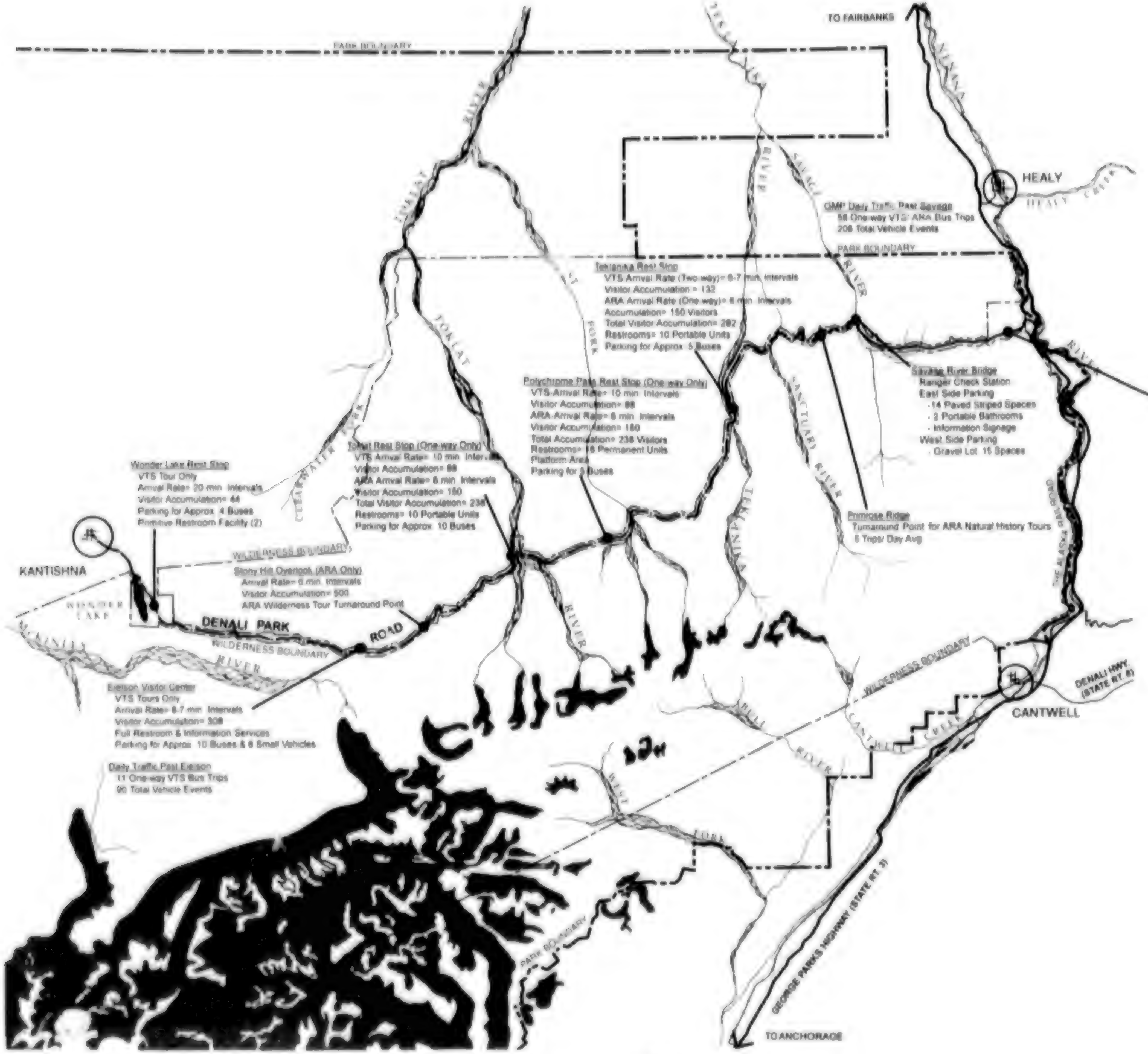
Once installed, a tramway system would have limited impacts on wildlife and the environment. The greatest impact of the system would be to the overall "concept" of the Denali wilderness as an area that contains no evidence of human impact. A tramway system would conflict with the traditional concept of wilderness, but in fact would have minimal impact on natural processes. It would not represent a barrier to wildlife movement and would effectively isolate visitors from the environment while providing excellent viewing opportunities. The aerial tramway offers a cost-effective means to transport relatively large numbers of visitors to locations with a great deal of visitor appeal.

This study is not intended to produce a recommended alternative for visitor transportation in Denali. The purpose of the effort to date has been to identify a range of feasible alternatives that should be analyzed in more detailed planning and engineering studies.

It appears that each of the bus and cog rail alternatives is worthy of more detailed study, as is a system to provide visitor access on the south slope if an exemption to the wilderness management policy is deemed to be warranted by the benefits of the tramway.

Funding availability will be a major consideration in deciding how to proceed with improvements for visitor transportation in Denali. A phased development approach that combines elements of each option could address the immediate needs of the park within currently available financial resources and would allow flexibility to respond to changing needs in the future.

EXISTING TRANSIT BASELINE CONDITIONS



Wonder Lake Rest Stop
VTS Tour Only
Arrival Rate= 20 min Intervals
Visitor Accumulation= 44
Parking for Approx 4 Buses
Primitive Restroom Facility (2)

Stony Hill Overlook (ARA Only)
Arrival Rate= 6 min Intervals
Visitor Accumulation= 500
ARA Wilderness Tour Turnaround Point

Eielson Visitor Center
VTS Tours Only
Arrival Rate= 6-7 min Intervals
Visitor Accumulation= 308
Full Restroom & Information Services
Parking for Approx 10 Buses & 6 Small Vehicles

Daily Traffic Past Eielson
11 One-way VTS Bus Trips
90 Total Vehicle Events

Toklat Rest Stop (One-way Only)
VTS Arrival Rate= 10 min Intervals
Visitor Accumulation= 88
ARA Arrival Rate= 6 min Intervals
Visitor Accumulation= 150
Total Visitor Accumulation= 238
Restrooms= 10 Portable Units
Parking for Approx 10 Buses

Polychrome Pass Rest Stop (One-way Only)
VTS-Arrival Rate= 10 min Intervals
Visitor Accumulation= 88
ARA-Arrival Rate= 6 min Intervals
Visitor Accumulation= 150
Total Accumulation= 238 Visitors
Restrooms= 18 Permanent Units
Platform Area
Parking for 5 Buses

Teklanika Rest Stop
VTS Arrival Rate (Two-way)= 6-7 min Intervals
Visitor Accumulation = 132
ARA Arrival Rate (One-way)= 6 min Intervals
Accumulation= 150 Visitors
Total Visitor Accumulation= 282
Restrooms= 10 Portable Units
Parking for Approx 5 Buses

GMP Daily Traffic Past Savage
58 One-way VTS/ ARA Bus Trips
208 Total Vehicle Events

Savage River Bridge
Ranger Check Station
East Side Parking
- 14 Paved Striped Spaces
- 2 Portable Bathrooms
- Information Signage

West Side Parking
- Gravel Lot 15 Spaces

Primrose Ridge
Turnaround Point for ARA Natural History Tours
5 Trips/ Day Avg

SERVICE AND CAPACITY
2 325 Daily Passenger Capacity
-1 175 VTS (avg)
-1 150 ARA (avg)

Departure Durations
VTS : Eielson= 9 hrs Wonder Lake & Camper= 6 hrs
Max of 6 Departures/Hour-35 Trips/Day
19 Trips to Eielson
6 Trips to Wonder Lake
10 Camper & Local Bus Trips

ARA : Stony Hill or Toklat= 3 5 hrs
Max of 10 Departures/Hour
Stony Hill/ Toklat
Total of 23 trips

Fleet Sizes	ARA Maintenance Facility
VTS= 75 Buses	3 360 Bldg s f Footprint (25% Usable Space Upstairs)
ARA= 32 Buses	4 200 s f Total Space
	30 [illegible] s f Storage Yard

Fuel Consumption
VTS Shuttles = 856 Gallons/ Day
Loop Bus = 13 Gallons/ Day (Not including Dog Demo Buses)
ARA Wilderness Tours = [illegible] Gallons/ Day (Denali Park Hotel To Stony Hill Overlook)
Total = 1 333 Gallons/ Day

Frontcountry Facilities
Riley Creek Parking Area
186 Long-term Parking Spaces
Restroom Facilities
Camper & Loop Bus Shuttle Stop

Visitor Access Center
130 Auto Parking Spaces
144 R V Parking Spaces
Visitor Information
Shuttle Bus Reservations
VTS Shuttle Bus Staging Area
Restroom Facilities

Denali Park Hotel
71 Visitor Parking Spaces
89 Employee Parking Spaces
ARA Tour Bus Office, Maintenance Facility
Tour Bus Reservations
Tour Bus Staging Area

VTS Shuttle Bus Staging Area
VTS-Approx 6 Departures/ Arrivals per Hour
Arrival Rate (2-way)= 10 min Intervals
Visitor Accumulation = 117

ARA Tour Bus Staging Area
ARA-Approx 20 Departures/ Arrivals per Hour
Arrival Rate (2-way)= 3 min Intervals
Visitor Loading and Unloading takes
place at a variety of locations (Lodging areas)

Frontcountry Shuttle
2 Trips/Hr
Stops at Riley Creek, Morino Campground, Visitor Activity Center
Denali Park Hotel, R R Depot, Horseshoe Lake Trailhead
350 Daily Passenger Demand

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ALTERNATIVE TRANSPORTATION
MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
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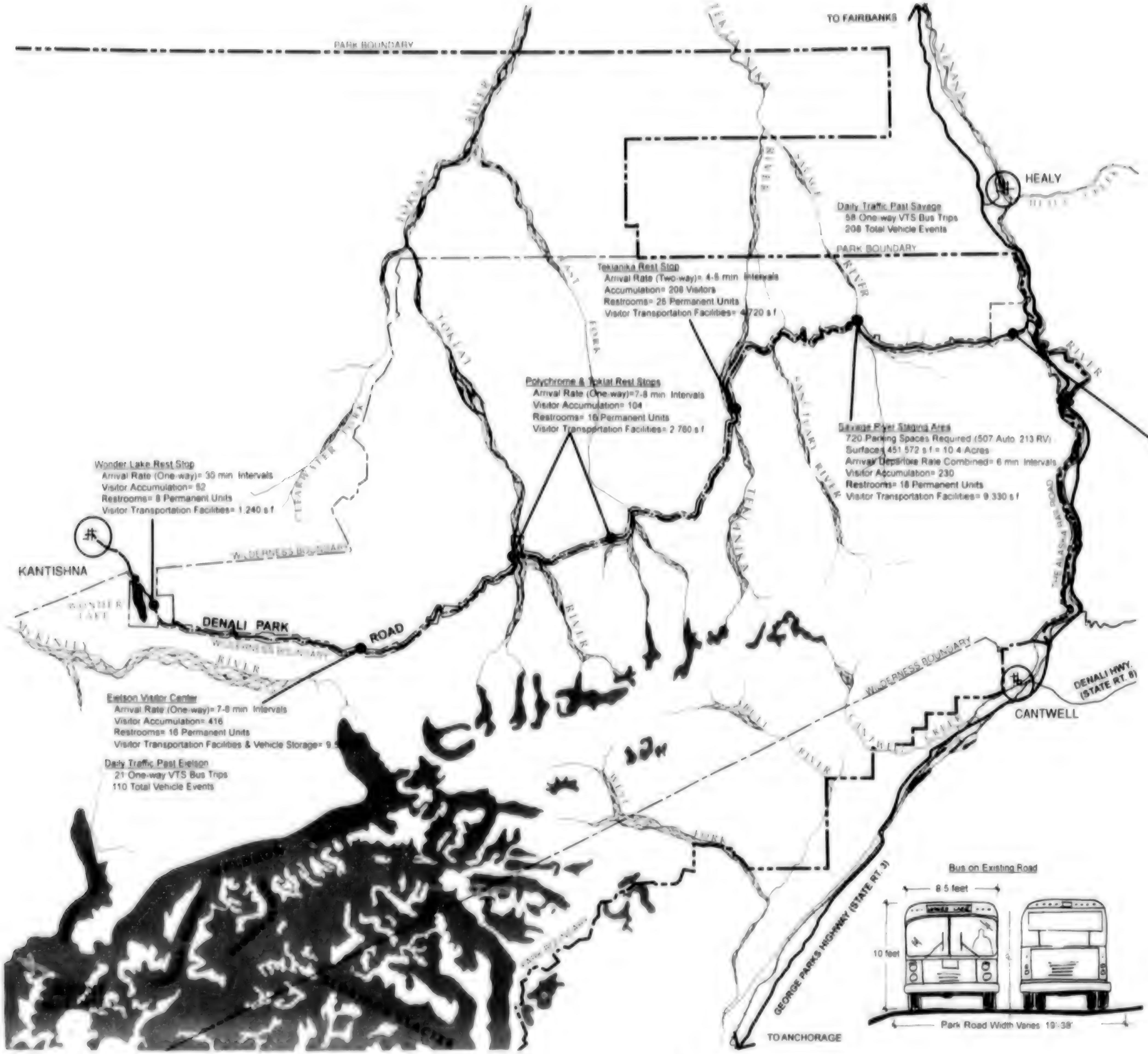
STANDARD BUS, NO STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY



Daily Traffic Past Savage
58 One-way VTS Bus Trips
208 Total Vehicle Events

Teklanika Rest Stop
Arrival Rate (Two-way)= 4-5 min. Intervals
Accumulation= 208 Visitors
Restrooms= 25 Permanent Units
Visitor Transportation Facilities= 4,720 s.f.

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)=7-8 min. Intervals
Visitor Accumulation= 104
Restrooms= 16 Permanent Units
Visitor Transportation Facilities= 2,780 s.f.

Savage River Staging Area
720 Parking Spaces Required (507 Auto, 213 RV)
Surfaces 451,572 s.f. = 10.4 Acres
Arrival/Departure Rate Combined= 6 min. Intervals
Visitor Accumulation= 230
Restrooms= 18 Permanent Units
Visitor Transportation Facilities= 9,330 s.f.

Wonder Lake Rest Stop
Arrival Rate (One-way)= 30 min. Intervals
Visitor Accumulation= 52
Restrooms= 8 Permanent Units
Visitor Transportation Facilities= 1,240 s.f.

Eielson Visitor Center
Arrival Rate (One-way)= 7-8 min. Intervals
Visitor Accumulation= 416
Restrooms= 16 Permanent Units
Visitor Transportation Facilities & Vehicle Storage= 9.5

Daily Traffic Past Eielson
21 One-way VTS Bus Trips
110 Total Vehicle Events

SERVICE AND CAPACITY
2,521 Daily Passenger Capacity
Departure Durations: Eielson= 9 Hrs, Wonder Lake & Camp [illegible] Hrs
17 Trips to Eielson
12 Trips to Wonder Lake
9 Camper Trips

Fleet Size (Assuming some Recycling)= 62 Buses

Maintenance Facility
8,150 s.f. Building Space
42,650 s.f. Storage Yard

Staff= 161 Transportation Employees

Fuel Consumption
VTS Bus= 1,169 Gallons/ Day
Frontcountry Shuttle Bus = 145 Gallons/Day
Total = 1,314 Gallons/ Day

Total Estimated Space Requirements= 511,572 s.f. = 11.7 Acres
Includes Parking, Visitor Facilities, Maintenance Facility and Vehicle Storage Yard
Does not Include New Roadways or Driveways

Frontcountry Shuttle
2 Trips/Hr
Stops at Riley Creek, Morino Campground, Denali Park Hotel
Visitor Activity Center, R.R. Depot, Savage Staging Area
417 Daily Passenger Demand

0 1 5 10 MILES

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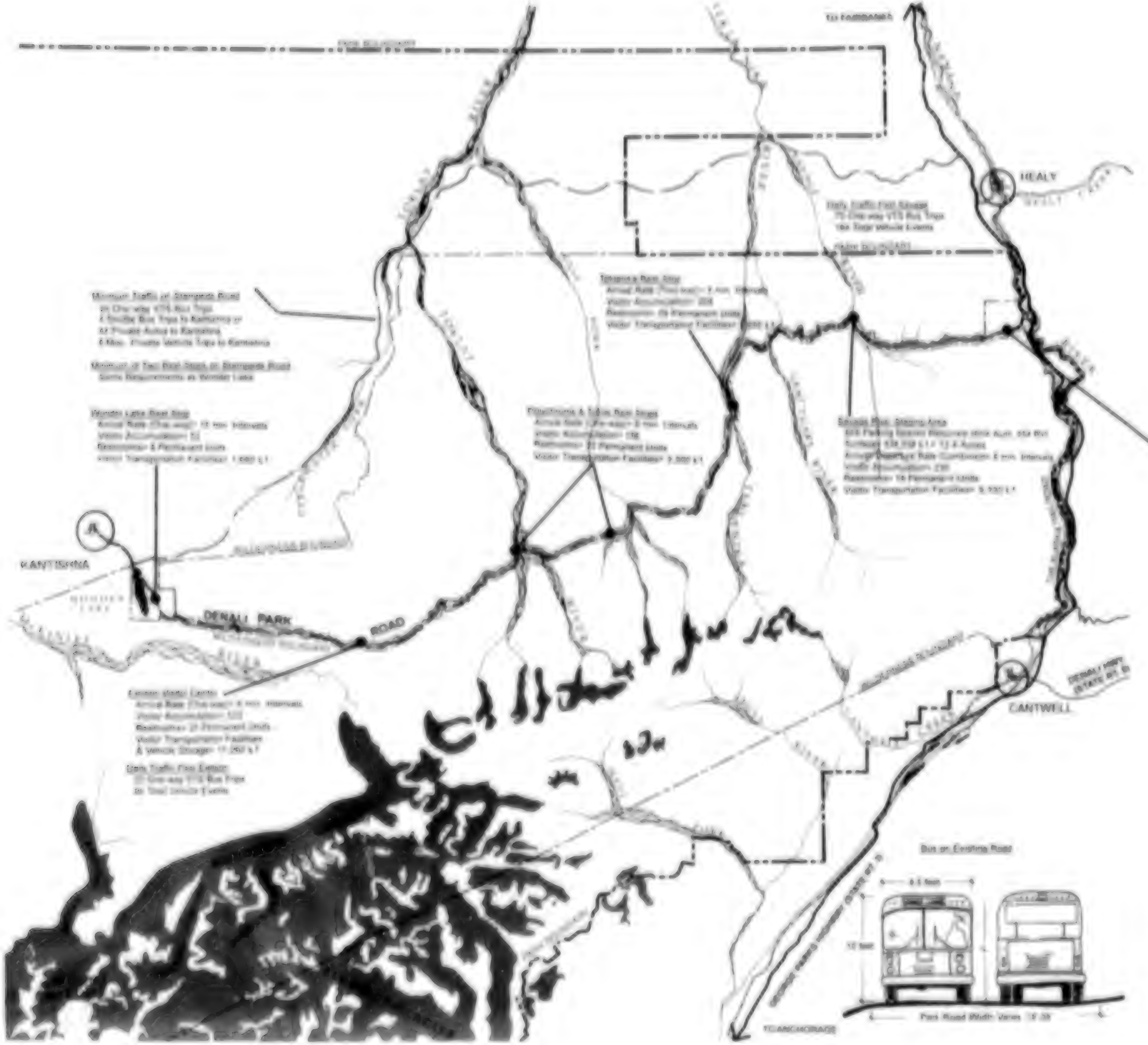

Minimum Traffic on Stampede Road
26 One-way VTS Bus Trips
4 Shuttle Bus Trips to Kantishna or
42 Private Autos to Kantishna
6 Max. Private Vehicle Trips to Kantishna

Minimum of Two Rest Stops on Stampede Road
Same Requirements as Wonder Lake

Wonder Lake Rest Stop
Arrival Rate (One-way)= 15 min. Intervals
Visitor Accumulation= 51
Restrooms= 8 Permanent Units
Visitor Transportation Facilities= 1,660 s.f.

Teklanika Rest Stop
Arrival Rate (Two-way)= 3 min. Intervals
Visitor Accumulation= 208
Restrooms= 28 Permanent Units
Visitor Transportation Facilities= 6,600 s.f.

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)= 5 min. Intervals
Visitor Accumulation= 156
Restrooms= 22 Permanent Units
Visitor Transportation Facilities= 5,000 s.f.

Daily Traffic Past Savage
75 One-way VTS Bus Trips
166 Total Vehicle Events

Savage River Staging Area
856 Parking Spaces Required (604 Auto, 252 RV)
Surfaces= 536,938 s.f.= 12.3 Acres
Arrival/ Departure Rate Combined= 2 min. Intervals
Visitor Accumulation= 235
Restrooms= 16 Permanent Units
Visitor Transportation Facilities= 5,330 s.f.

Eielson Visitor Center
Arrival Rate (One-way)= 4 min. Intervals
Visitor Accumulation= 123
Restrooms= 21 Permanent Units
Visitor Transportation Facilities
& Vehicle Storage= 11,260 s.f.

Daily Traffic Past Eielson
37 One-way VTS Bus Trips
86 Total Vehicle Events

STANDARD BUS, WITH STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY

SERVICE AND CAPACITY
5,013 Daily Passenger Capacity
Departure Durations: Eielson= 5 Hrs., Wonder Lake & Campers= 6 Hrs.
37 Trips to Eielson
26 Trips to Wonder Lake
8 Camper Trips

Fleet Size (Assuming 10% Reserve)= 75 Buses

Maintenance Facility
8,850 s.f. Building Space
11,650 s.f. Storage Yard

Staff= 235 Transportation Employees

Fuel Consumption
VTS Bus= 1,598 Gallons/ Day
Frontcountry Shuttle Bus= 145 Gallons/ Day
Total = 1,743 Gallons/ Day

Total Estimated Space Requirements= 638,980 s.f.= 14.5 Acres
Includes Parking, Visitor Facilities, Maintenance Facility
and Vehicle Storage Yard
Does Not Include New Roadways or Driveways

Frontcountry Shuttle
2 Trips/ Hr.
Stops at Riley Creek, Morino Campground, Denali Park Hotel,
Visitor Activity Center, R.R. Depot, Savage Staging Area
417 Daily Passenger Demand

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LARGE BUS, NO STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY

SERVICE AND CAPACITY
2,595 Daily Passenger Capacity
Departure Durations: Eielson= 8 Hrs. Wonder Lake & Campers= 6 Hrs
 26 Trips to Eielson
 15 Trips to Wonder Lake
 6 Camper Trips

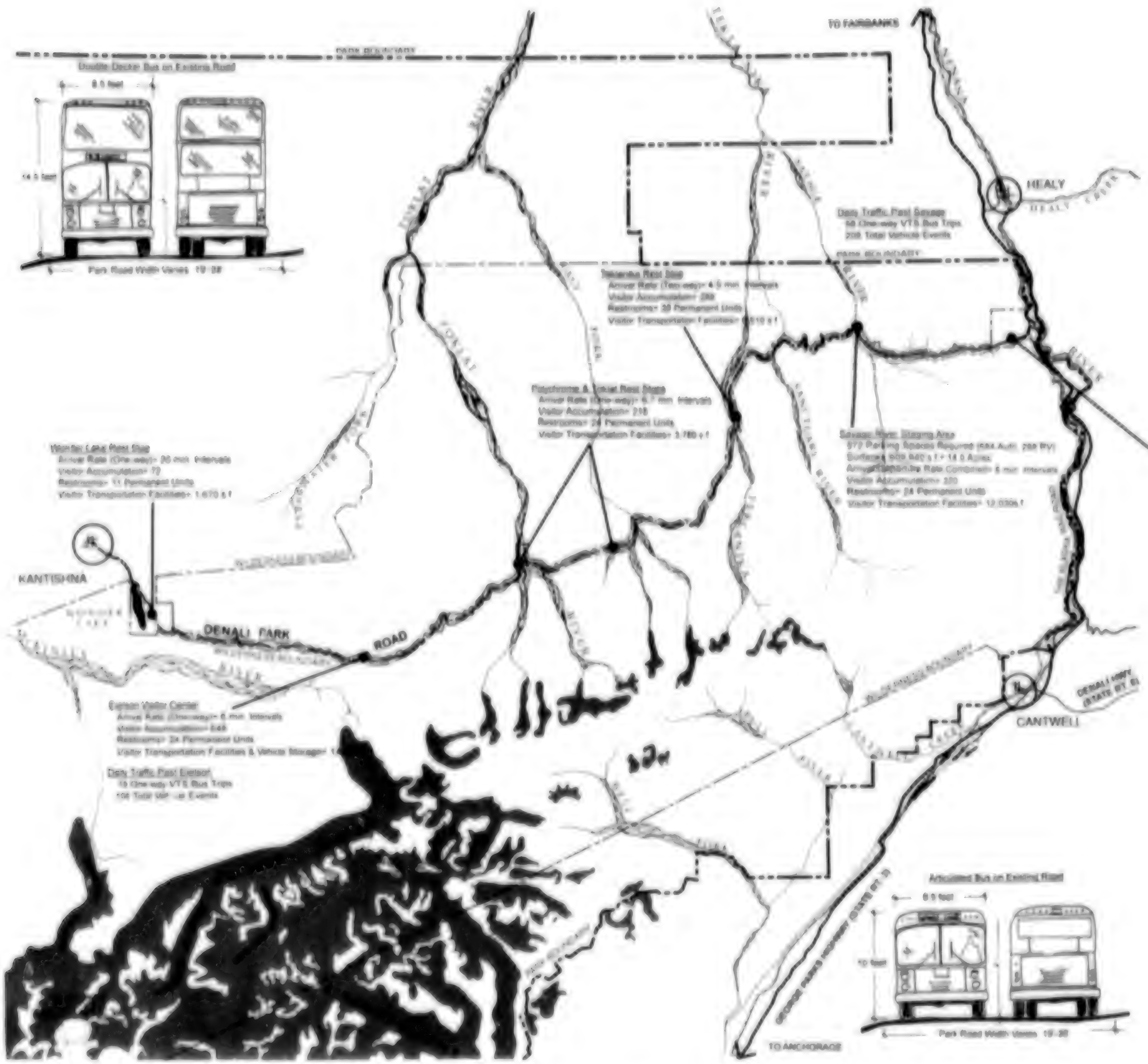
Fleet Size (Assuming some Recycling)= 63 Buses

Maintenance Facility
 8,750 s.f. Building Space
 54,750 s.f. Storage Yard

Staff= 184 Transportation Employees

Fuel Consumption
 VTS Bus= 2,312 Gallons/Day
 Frontcountry Shuttle Bus = 165 Gallons/Day
 Total = 2,477 Gallons/Day

Total Estimated Space Requirements= 684,870 s.f.= 15.7 Acres
 Includes Parking, Visitor Facilities, Maintenance Facility and Vehicle Storage Yard
 Does Not Include new Roadways or Driveways



Double Decker Bus on Existing Road

Articulated Bus on Existing Road

Wonder Lake Rest Stop
Arrival Rate (One-way)= 20 min. Intervals
Visitor Accumulation= 72
Restrooms= 11 Permanent Units
Visitor Transportation Facilities= 1,670 s.f.

Eielson Visitor Center
Arrival Rate (One-way)= 6 min. Intervals
Visitor Accumulation= 548
Restrooms= 24 Permanent Units
Visitor Transportation Facilities & Vehicle Storage= 1

Daily Traffic Past Eielson
15 One-way VTS Bus Trips
106 Total Vehicle Events

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)= 6.7 min. Intervals
Visitor Accumulation= 210
Restrooms= 24 Permanent Units
Visitor Transportation Facilities= 3,780 s.f.

Teklanika Rest Stop
Arrival Rate (Two-way)= 4.5 min. Intervals
Visitor Accumulation= 280
Restrooms= 28 Permanent Units
Visitor Transportation Facilities= 6,510 s.f.

Daily Traffic Past Savage
58 One-way VTS Bus Trips
208 Total Vehicle Events

Savage River Staging Area
972 Parking Spaces Required (684 Auto, 288 RV)
Surfaces 609,840 s.f.= 14.0 Acres
Arrival/Departure Rate Combined= 5 min. Intervals
Visitor Accumulation= 320
Restrooms= 24 Permanent Units
Visitor Transportation Facilities= 12,030 s.f.

Frontcountry Shuttle
Stops at Riley Creek, Morino Campground, Denali Park Hotel, Visitor Activity Center, R.R. Depot, Savage Staging Area
417 Daily Passenger Demand

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LARGE BUS, WITH STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY

SERVICE AND CAPACITY
4,300 Daily Passenger Capacity
Departure Intervals: Eielson= 9 min., Wonder Lake & Campers= 6 min.
39 Trips to Eielson
20 Trips to Wonder Lake
6 Camper Trips

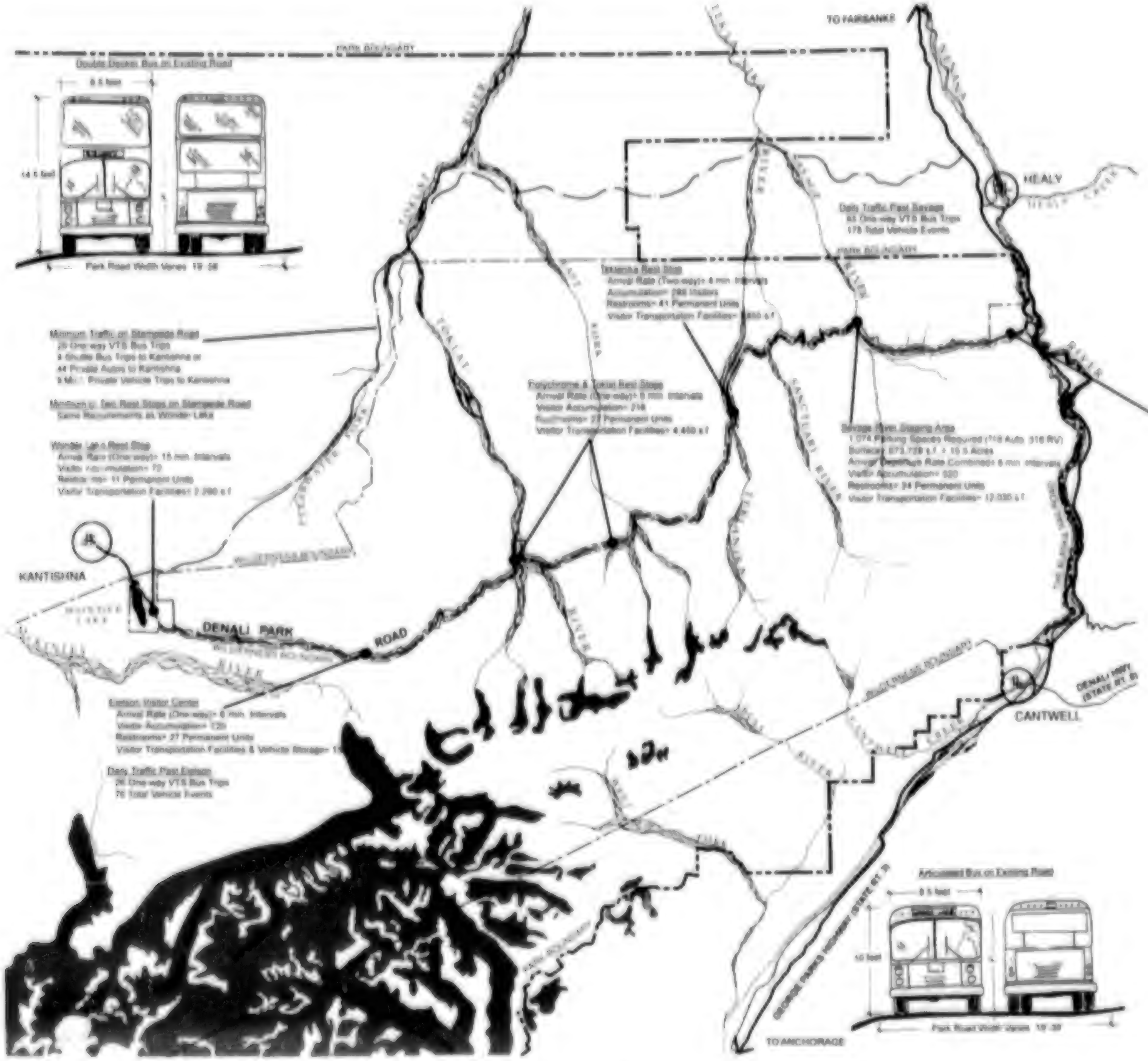
Fleet Size (Assuming some Recycling)= 73 Buses
Maintenance Facility
6,250 s.f. Building Space
61,000 s.f. Storage Yard

Staff= 190 Transportation Employees

Fuel Consumption
VTS Bus= 2,880 Gallons/Day
Frontcountry Shuttle Bus = 145 Gallons/Day
Total = 3,025 Gallons/Day

Total Estimated Space Requirements= 755,958 s.f.= 17.4 Acres
Includes Parking, Visitor Facilities, Maintenance Facility and Vehicle Storage Yard
Does Not Include New Roadways or Driveways

Frontcountry Shuttle
2 Trips/Hr.
Stops at Riley Creek, Morino Campground, Denali Park Hotel, Visitor Activity Center, R.R. Depot, Savage Staging Area
417 Daily Passenger Demand



Daily Traffic Past Savage
65 One-way VTS Bus Trips
178 Total Vehicle Events

Teklanika Rest Stop
Arrival Rate (Two-way)= 4 min. Intervals
Accumulation= 288 Visitors
Restrooms= 41 Permanent Units
Visitor Transportation Facilities= 5,800 s.f.

Minimum Traffic on Stampede Road
26 One-way VTS Bus Trips
4 Shuttle Bus Trips to Kantishna or
44 Private Autos to Kantishna
8 Min. Private Vehicle Trips to Kantishna

Minimum of Two Rest Stops on Stampede Road
Same Requirements as Wonder Lake

Wonder Lake Rest Stop
Arrival Rate (One-way)= 15 min. Intervals
Visitor Accumulation= 72
Restrooms= 11 Permanent Units
Visitor Transportation Facilities= 2,280 s.f.

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)= 6 min. Intervals
Visitor Accumulation= 216
Restrooms= 27 Permanent Units
Visitor Transportation Facilities= 4,400 s.f.

Savage River Staging Area
1,074 Parking Spaces Required (716 Auto, 318 RV)
Surface= 873,720 s.f. = 19.5 Acres
Arrival/Departure Rate Combined= 6 min. Intervals
Visitor Accumulation= 320
Restrooms= 34 Permanent Units
Visitor Transportation Facilities= 12,030 s.f.

Eielson Visitor Center
Arrival Rate (One-way)= 6 min. Intervals
Visitor Accumulation= 120
Restrooms= 27 Permanent Units
Visitor Transportation Facilities & Vehicle Storage= 1

Daily Traffic Past Eielson
26 One-way VTS Bus Trips
76 Total Vehicle Events

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EVALUATION SUMMARY CHART
BUS VTS ALTERNATIVES

	Standard Bus (41 Pass.) **No Stampede Road**	**Standard Bus (41 Pass.)** **With Stampede Road**	**Large Bus (72 Pass.)** **No Stampede Road**	**Large Bus (72 Pass.)** **With Stampede Road**
Visitor Transportation and Management				
Daily Visitors Served	**3,621 (17% more than existing)**	**3,971 (42% more than existing)**	**3,591 (66% more than existing)**	**4,460 (85% more than existing)**
Access to Key Locations	Requires Intermediary shuttle to Savage for overnight visitors	Alternate access for backcountry users on Stampede Road **Requires Intermediary shuttle to Savage for overnight visitors** **No transit requirements for Kantishna visitors on park road**	Requires Intermediary shuttle to Savage for overnight visitors	Alternate access for backcountry users on Stampede Road Requires Intermediary shuttle to Savage for overnight visitors **No transit requirements for Kantishna visitors on park road**
Visitor Experience				
Views	**Buses could be modified to blend into surroundings and provide better views with more window space**	**Buses could be modified to blend into surroundings and provide better views with more window space**	**Buses could be modified to blend into surroundings and provide better views with more window space**	Buses could be modified to blend into surroundings and provide better views with more window space
Comfort	Could be improved slightly	Could be improved slightly	Could be improved slightly	Could be improved slightly
Character	Same basic character	Same basic character	Same basic character	Same basic character
Other	Activity disturbance to Savage campground users Dusty roads impact views	Activity disturbance to Savage campground users Dusty roads impact views	Activity disturbance to Savage campground users Dusty roads impact views	Activity disturbance to Savage campground users Dusty roads impact views
Resource Impact				
Peak Daily One-Way Vehicle Trips Past Primrose	**208 (same as existing)**	**184 (24 or 11.5% less than existing)** **Divert Kantishna traffic from wilderness corridor**	**208 (same as existing)**	**178 (30 or 14% less than existing)** **Divert Kantishna traffic from wilderness corridor**
Wilderness Encroachment	**12.7 acres at Savage**	**14.8 acres at Savage**	**12.7 acres at Savage**	**17.4 acres at Savage**
Wildlife, Vegetation, Water, Soils, Air		**Permanent segmentation of pristine park habitat** **Increased potential for poaching** **Impacts on natural vegetation in Stampede corridor**	Potential increase in road maintenance material source requirements in park due to heavier buses	Potential increase in road maintenance material source requirements in park due to heavier buses **Permanent segmentation of pristine Park habitat** **Increased potential for poaching** **Impacts on natural vegetation in Stampede corridor**
Cultural		**Probable archeological and historic disturbance in Kantishna and along the Stampede Road corridor**		**Probable archeological and historic disturbance in Kantishna and along the Stampede Road corridor**
Construction Impacts	Impacts in and outside park from material extraction and importation activities	Impacts in and outside park from material extraction and importation activities **Two seasons of wildlife disturbance in Stampede corridor** Water quality and resource impacts in Stampede corridor Construction crew housing required	Impacts in and outside park from material extraction and importation activities	Impacts in and outside park from material extraction and importation activities **Two seasons of wildlife disturbance in Stampede corridor** Water quality and resource impacts in Stampede corridor Construction crew housing required
Consistency With NPS and Regional Planning Goals				
Park Management	**Reservation system required for efficient operation** Could be exclusively operated by concessioner	Major development pressures in Kantishna **Reservation system required for efficient operation** Could be exclusively operated by concessioner **Major new area to patrol for resource protection and visitor needs**	**Reservation system required for efficient operation** Could be exclusively operated by concessioner **Possible single track operations required in narrow sections**	Major development pressures in Kantishna **Reservation system required for efficient operation** Could be exclusively operated by concessioner **Major new area to patrol for resource protection and visitor needs** **Possible "single track" operations required in narrow sections**
Offsite Impacts	More hotel rooms for package tours (17%) Non-tour overnight demand could decline with reservation system	More hotel rooms for package tours (42%) Some non-tour overnight demand increase, offset by reservations system **Major gravel source and delivery requirements** **Residential area in Eight Mile Lake impacted by Stampede Road traffic** **Development pressure in Wolf Township**	More hotel rooms for package tours (66%) Some non-tour overnight demand increase, offset by reservations system Some additional gravel source and delivery requirements	More hotel rooms for package tours (95%) Some non-tour overnight demand increase, offset by reservations system **Major gravel source and delivery requirements** **Residential area in Eight Mile Lake impacted by Stampede Road traffic** **Development pressure in Wolf Township**
Cost and Cost Effectiveness				
Construction and Equipment Costs	$21.4 million (62 buses)	$194.0 million (75 buses)	$36.7 million (43 buses)	$209.3 million (79 buses)
Annual Operating and Maintenance Costs	$3.2 million	$4.2 million	$3.4 million	$4.2 million
Annualized Cost/Visitor	**$18.61**	**$55.28**	**$17.60**	**$49.24**
Implementation				
Compliance Issues	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel extraction	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel extraction Major EIS for Stampede Road corridor Requires wilderness management exemption	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel extraction	DCP/EIS at Savage River DCP/EA for facilities on road and any gravel extraction Major for Stampede Road corridor Requires Wilderness management exemption
Number of Employees	**161 transportation employees**	Probable increase in ranger and interpretation staff needed for higher visitor levels Additional maintenance staff required for Stampede Road **208 transportation employees**	Probable increase in ranger and interpretation staff needed for higher visitor levels Potential increase in maintenance staff due to heavier axle loads **164 transportation employees**	Probable increase in ranger and interpretation staff needed for higher visitor levels Potential increase in maintenance staff due to heavier axle loads Additional maintenance staff required for Stampede Road **199 transportation employees**

COG RAIL TO EIELSON, NO STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY

SERVICE AND CAPACITY
4,147 Daily Passenger Capacity (4,000 + Kantishna
Other Private and NPS Passengers)
Departure Durations to Eielson = 9 Hrs
22 Trips to Eielson

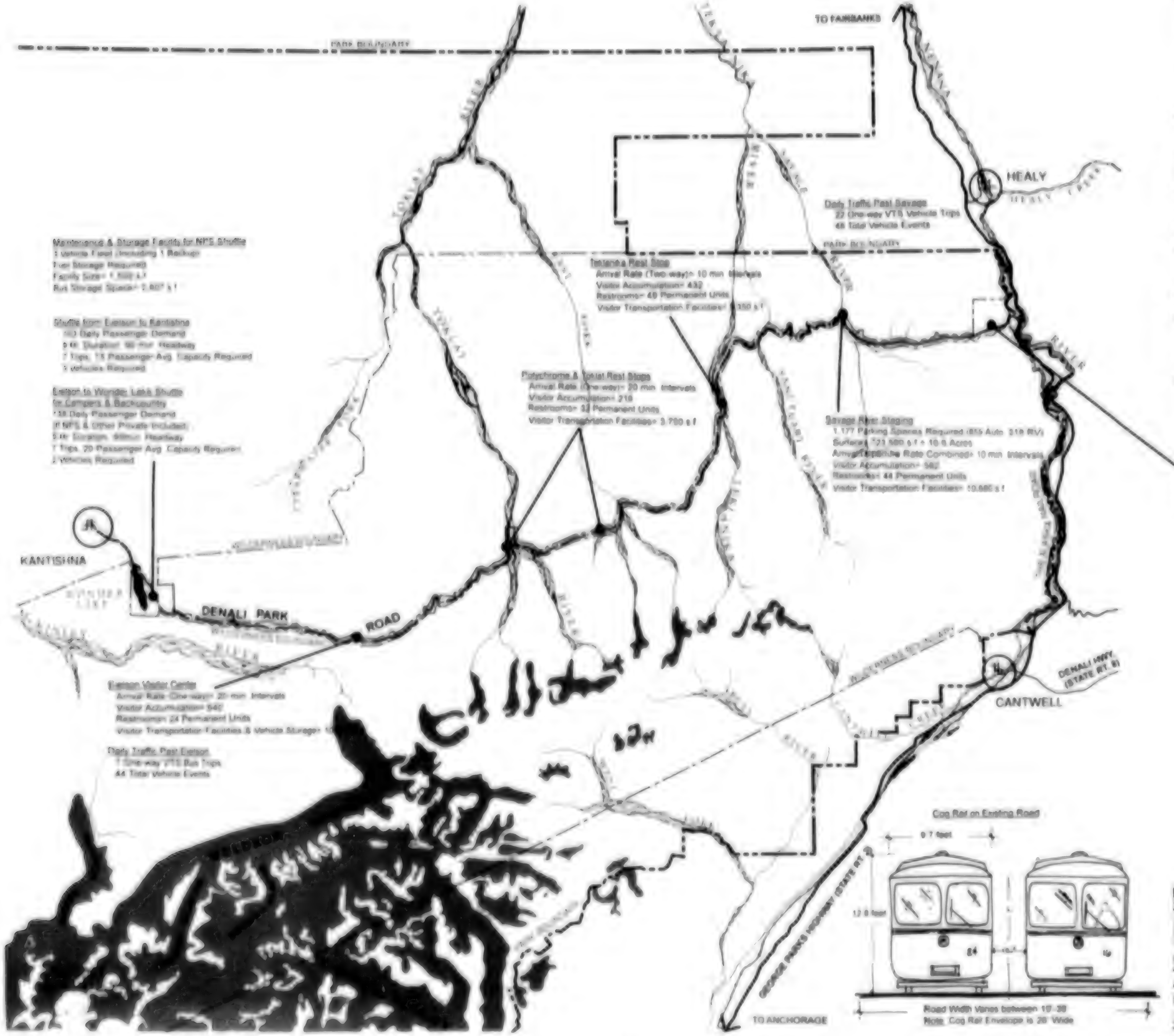
Fleet Size (Assuming some Recycling)= 24 Trains, 7 Buses

Maintenance Facility
Rail: 42,240 s.f. Building + 38,710 s.f. Storage Space
Bus: (Frontcountry Shuttle): Existing Facility

Staff= 99 Transportation Employees

Fuel Consumption
Rail= 2,341 to 4,682 Gallons/Day
Frontcountry Shuttle Bus = 145 Gallons/Day
Eielson to Wonder Lake Shuttle Bus=47 Gallons/Day
Total= 2,533 to 4,874 Gallons/Day

Total Estimated Space Requirements= 825,210 s.f. = 18.9 Acres
Includes Parking, Visitor Facilities, Maintenance Facility
and Vehicle Storage Yard
Does Not Include new Roadways or Driveways



Frontcountry Shuttle
2 Trips/Hr
Stops at Riley Creek, Morino Campground, Denali Park Hotel,
Visitor Activity Center, R.R. Depot, Savage Staging Area
417 Daily Passenger Demand

Maintenance & Storage Facility for NPS Shuttle
1 Vehicle Fleet (Including 1 Backup)
Fuel Storage Required
Facility Size= 1,500 s.f.
Bus Storage Space= 1,607 s.f.

Shuttle from Eielson to Kantishna
110 Daily Passenger Demand
5 Hr. Duration, 90 min. Headway
7 Trips, 15 Passenger Avg. Capacity Required
3 Vehicles Required

Eielson to Wonder Lake Shuttle
for Campers & Backcountry
138 Daily Passenger Demand
(If NPS & Other Private Included)
5 Hr. Duration, 90min. Headway
7 Trips, 20 Passenger Avg. Capacity Required
2 Vehicles Required

Teklanika Rest Stop
Arrival Rate (Two-way)= 10 min. Intervals
Visitor Accumulation= 432
Restrooms= 40 Permanent Units
Visitor Transportation Facilities= 5,350 s.f.

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)= 20 min. Intervals
Visitor Accumulation= 218
Restrooms= 32 Permanent Units
Visitor Transportation Facilities= 3,750 s.f.

Daily Traffic Past Savage
22 One-way VTS Vehicle Trips
48 Total Vehicle Events

Savage River Staging
1,177 Parking Spaces Required (858 Auto, 319 RV)
Surfaced 723,580 s.f. = 16.6 Acres
Arrival/Departure Rate Combined= 10 min. Intervals
Visitor Accumulation= 582
Restrooms= 44 Permanent Units
Visitor Transportation Facilities= 10,680 s.f.

Eielson Visitor Center
Arrival Rate (One-way)= 20 min. Intervals
Visitor Accumulation= 540
Restrooms= 24 Permanent Units
Visitor Transportation Facilities & Vehicle Storage= 10

Daily Traffic Past Eielson
7 One-way VTS Bus Trips
44 Total Vehicle Events

Cog Rail on Existing Road

Road Width Varies between 15'-30'
Note: Cog Rail Envelope is 26' Wide

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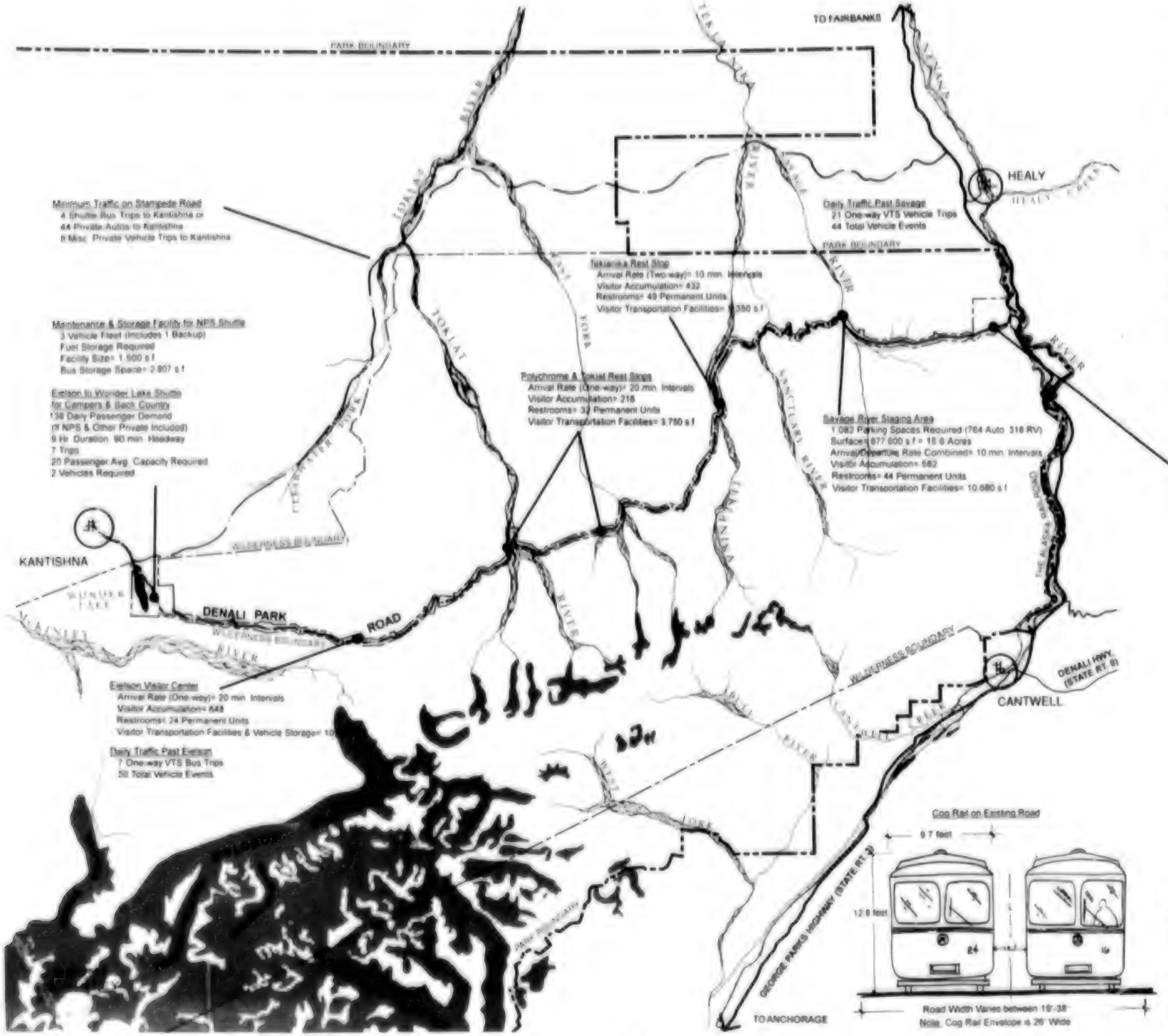
COG RAIL TO EIELSON, WITH STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY



Minimum Traffic on Stampede Road
4 Shuttle Bus Trips to Kantishna or
44 Private Autos to Kantishna
8 Misc. Private Vehicle Trips to Kantishna

Maintenance & Storage Facility for NPS Shuttle
3 Vehicle Fleet (Includes 1 Backup)
Fuel Storage Required
Facility Size= 1,500 s.f
Bus Storage Space= 2,807 s.f

Eielson to Wonder Lake Shuttle for Campers & Back Country
138 Daily Passenger Demand
(If NPS & Other Private Included)
9 Hr. Duration, 90 min. Headway
7 Trips
20 Passenger Avg. Capacity Required
2 Vehicles Required

Teklanika Rest Stop
Arrival Rate (Two-way)= 10 min. Intervals
Visitor Accumulation= 432
Restrooms= 49 Permanent Units
Visitor Transportation Facilities= [illegible]350 s.f

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)= 20 min. Intervals
Visitor Accumulation= 216
Restrooms= 32 Permanent Units
Visitor Transportation Facilities= 3,750 s.f

Daily Traffic Past Savage
21 One-way VTS Vehicle Trips
44 Total Vehicle Events

Savage River Staging Area
1,082 Parking Spaces Required (764 Auto, 318 RV)
Surface= 677,600 s.f = 15.6 Acres
Arrival/Departure Rate Combined= 10 min. Intervals
Visitor Accumulation= 582
Restrooms= 44 Permanent Units
Visitor Transportation Facilities= 10,680 s.f

Eielson Visitor Center
Arrival Rate (One-way)= 20 min. Intervals
Visitor Accumulation= 648
Restrooms= 24 Permanent Units
Visitor Transportation Facilities & Vehicle Storage= 10

Daily Traffic Past Eielson
7 One-way VTS Bus Trips
30 Total Vehicle Events

Cog Rail on Existing Road

Road Width Varies between 19'-38'
Note: Cog Rail Envelope is 26' Wide

SERVICE AND CAPACITY
4,044 Daily Passenger Capacity (4,000 + Other Private and NPS Passengers)
Departure Durations: Eielson= 9 Hrs
21 Trips to Eielson

Fleet Size (Assuming some Recycling)= 24 Trains, 7 Buses

Maintenance Facility
Rail: 42,240 s.f. Building, 38,710 s.f. Storage Space
Bus: (Frontcountry Shuttle): Existing Facility

Staff= 116 Transportation Employees

Fuel Consumption
Rail= 2,234 to 4,469 Gallons/ Day
Eielson to Wonder Lake Shuttle Bus= 47 Gallons/ Day
Front Country Shuttle Bus= 145 Gallons/ Day
Total= 2,426 to 4,661 Gallons/ Day

Total Estimated Space Requirements= 769,230 s.f = 17.7 Acres
-Includes Parking, Visitor Facilities, Maintenance Facility and Vehicle Storage Yard
-Does Not Include new Roadways or Driveways

Frontcountry Shuttle
2 Trips/Hr.
Stops at Riley Creek, Morino Campground, Denali Park Hotel
Visitor Activity Center, R.R. Depot, Savage Staging Area
417 Daily Passenger Demand

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ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
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COG RAIL TO WONDER LAKE, NO STAMPEDE ROAD ALTERNATIVE INFORMATION SUMMARY

SERVICE AND CAPACITY
4 147 Daily Passenger Capacity (4,000 + Kantishna
Other Private and NPS Passengers)
Departure Durations Wonder Lake = 6 Hrs
22 Trips to Wonder Lake

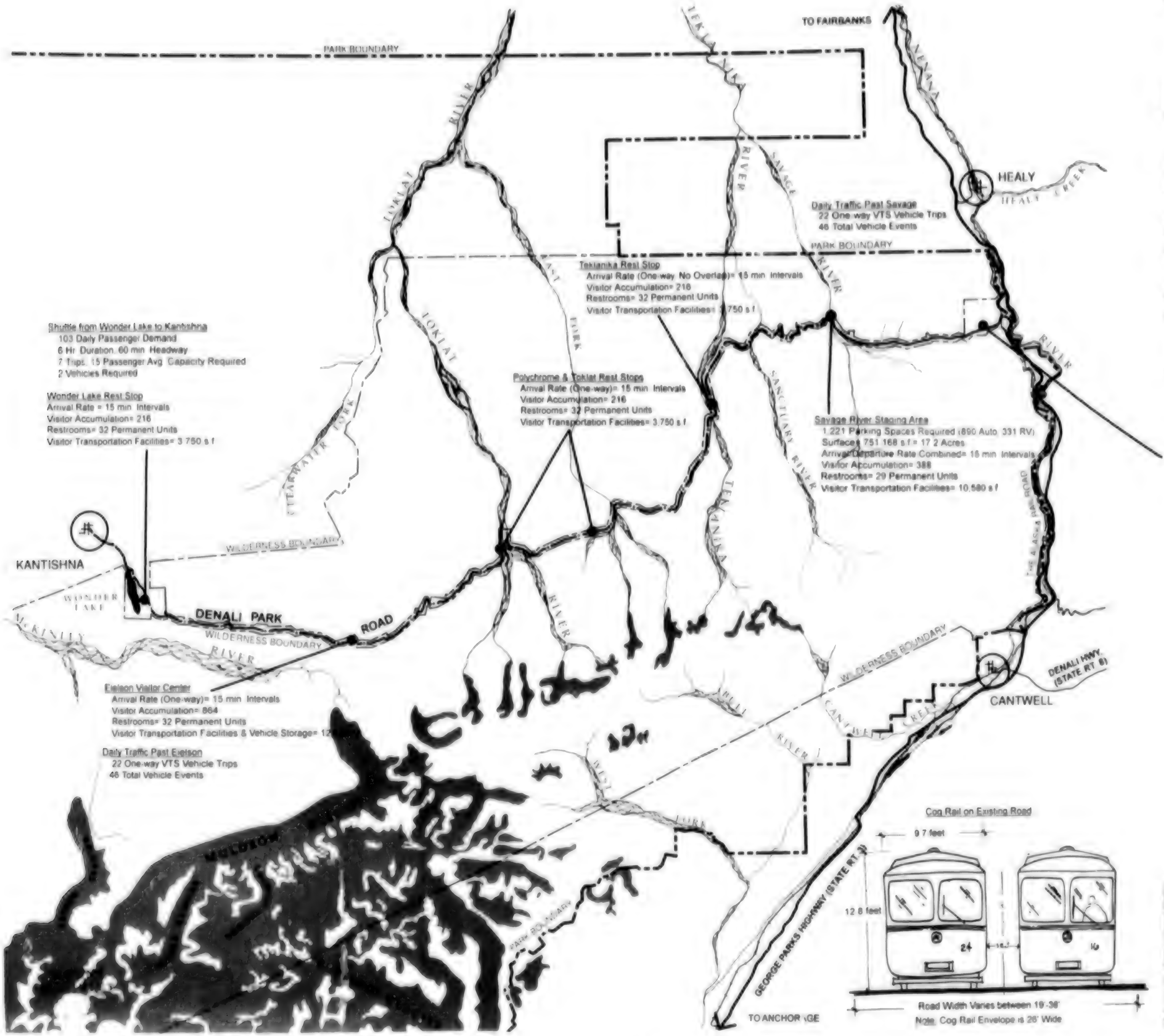
Fleet Size (Assuming some Recycling)= 26 Trains, 4 Buses

Maintenance Facility
Rail 45 760 s f Building / 41 935 s f Storage Space
Bus (Frontcountry Shuttle) Existing Facility

Staff= 106 Transportation Employees

Fuel Consumption
Rail= 3 225 to 6 450 Gallons/ Day
Frontcountry Shuttle Bus = 145 Gallons/Day
Total= 3 370 to 6 595 Gallons/ Day

Total Estimated Space Requirements= 849 443 s f = 19 5 Acres
-Includes Parking Visitor Facilities Maintenance Facility
and Vehicle Storage Yard
Does Not Include new Roadways or Driveways



Frontcountry Shuttle
2 Trips/Hr
Stops at Riley Creek Morino Campground Denali Park Hotel
Visitor Activity Center, R R Depot Savage Staging Area
417 Daily Passenger Demand

Daily Traffic Past Savage
22 One-way VTS Vehicle Trips
46 Total Vehicle Events

Tekianika Rest Stop
Arrival Rate (One-way No Overlap)= 15 min Intervals
Visitor Accumulation= 216
Restrooms= 32 Permanent Units
Visitor Transportation Facilities= 3 750 s f

Shuttle from Wonder Lake to Kantishna
103 Daily Passenger Demand
6 Hr Duration, 60 min Headway
7 Trips, 15 Passenger Avg Capacity Required
2 Vehicles Required

Wonder Lake Rest Stop
Arrival Rate = 15 min Intervals
Visitor Accumulation= 216
Restrooms= 32 Permanent Units
Visitor Transportation Facilities= 3 750 s f

Polychrome & Toklat Rest Stops
Arrival Rate (One-way)= 15 min Intervals
Visitor Accumulation= 216
Restrooms= 32 Permanent Units
Visitor Transportation Facilities= 3,750 s f

Savage River Staging Area
1 221 Parking Spaces Required (890 Auto 331 RV)
Surfaces 751 168 s f = 17 2 Acres
Arrival/Departure Rate Combined= 15 min Intervals
Visitor Accumulation= 388
Restrooms= 29 Permanent Units
Visitor Transportation Facilities= 10,580 s f

Eielson Visitor Center
Arrival Rate (One-way)= 15 min Intervals
Visitor Accumulation= 864
Restrooms= 32 Permanent Units
Visitor Transportation Facilities & Vehicle Storage= 12

Daily Traffic Past Eielson
22 One-way VTS Vehicle Trips
46 Total Vehicle Events

Cog Rail on Existing Road

Road Width Varies between 19'-36'
Note: Cog Rail Envelope is 26' Wide

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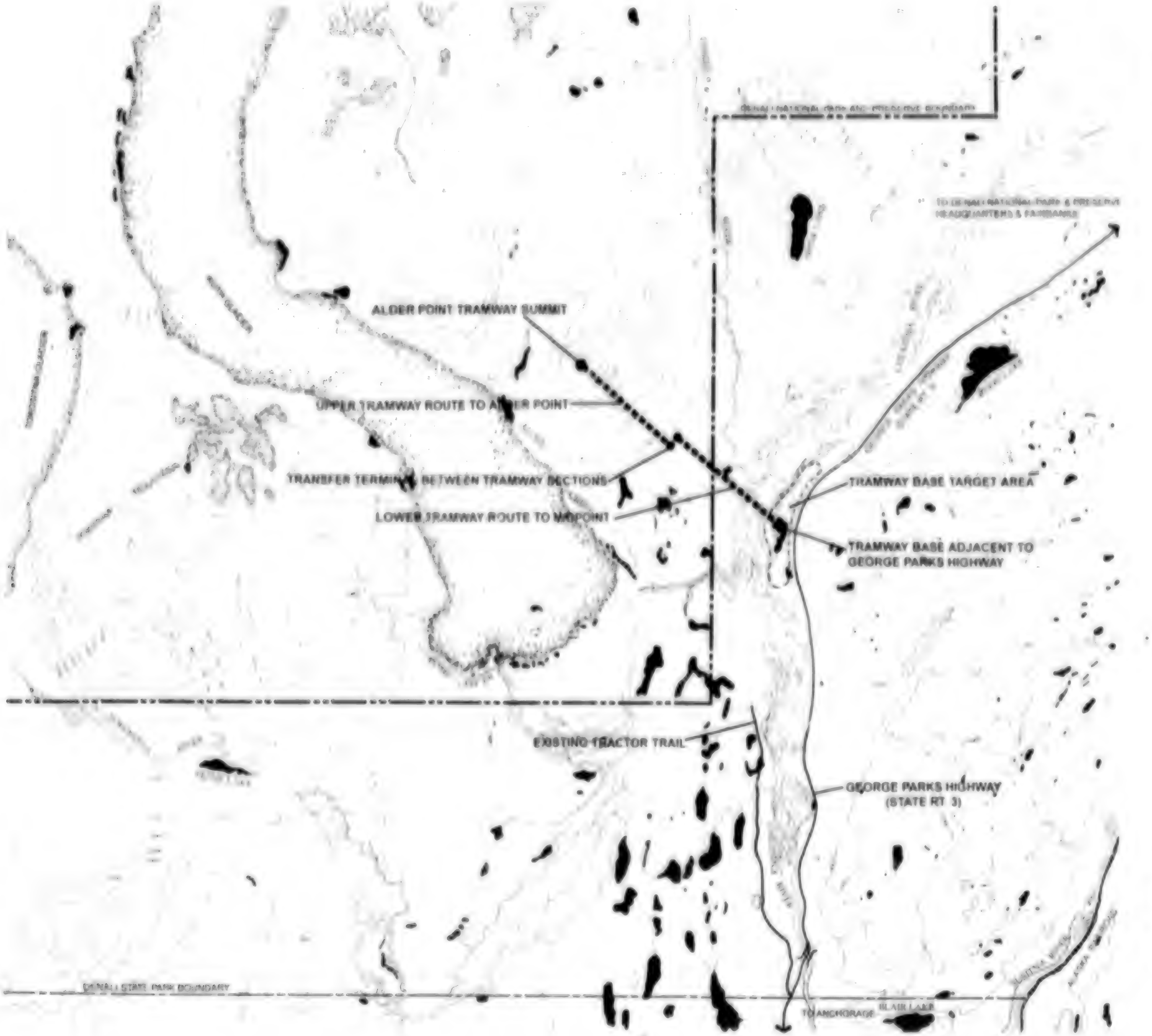
COG RAILWAY VTS ALTERNATIVES

	Cog Rail (216 Pass) to Eielson, Replacing Existing Road, No Stampede Road	Cog Rail (216 Pass.) to the Eielson, Replacing Existing Road, With Stampede Road	Cog Rail (216 Pass.) to Wonder Lake, Replacing Existing Road, No Stampede Road
Visitor Transportation and Management			
Daily Visitors Served	4,800 (80% more than existing) Must serve Kantishna and miscellaneous visitors	4,800 (80% more than existing)	4,800 (80% more than existing) Must serve Kantishna and miscellaneous visitors
Access to Key Locations	Requires frontcountry shuttle to Savage for overnight visitors Requires shuttle from Eielson for overnight visitors and Kantishna visitors No public access beyond staging areas during construction (2+ seasons, stages of access could occur) Less prone to closure due to structure failure of guideway No Kantishna access via park road corridor during initial construction	Requires frontcountry shuttle to Savage for overnight visitors Requires shuttle from Eielson for overnight visitors No transit requirements for Kantishna visitors Alternate access for backcountry users on Stampede Road No public access beyond staging areas during construction (2+ seasons, stages of access could occur) Less prone to closure due to structure failure of guideway No Kantishna access via park road corridor during initial construction	Requires frontcountry shuttle to Savage for overnight visitors Requires shuttle from Wonder Lake for Kantishna visitors No public access beyond staging areas during construction (2+ seasons, stages of access could occur) Less prone to closure due to structure failure of guideway No Kantishna access via park road corridor during initial construction
Visitor Experience			
Comfort	More comfortable than buses	More comfortable than buses	More comfortable than buses
Character	More in character with mountain experience	More in character with mountain experience	More in character with mountain experience
Other	Eliminates special access for private vehicles Requires transfers to Wonder Lake and Kantishna Eliminates dust Disturbance to Savage campground users	Eliminates special access for private vehicles Requires transfers to Wonder Lake Eliminates dust Disturbance to Savage campground users	Eliminates special access for private vehicles Requires transfers to Kantishna Eliminates dust Disturbance to Savage campground users
Resource Impact			
Peak Daily One-Way Vehicle Trips Past Primrose	46 (162 or 78% less than existing)	44 (164 or 79% less than existing)	46 (162 or 78% less than existing)
Peak Daily One-Way Vehicle Trips Between Eielson and Wonder Lake	44 (46 or 51% less than existing)	20 (60 or 33% less than existing) Divert Kantishna traffic from wilderness corridor	46 (44 or 49% less than existing)
Wilderness Encroachment	18.9 acres at Savage Possible minor intrusions in confined areas Shuttle maintenance facility required in Eielson for Wonder Lake segment	17.7 acres at Savage Possible minor intrusions in confined areas Shuttle maintenance facility required in Eielson for Wonder Lake segment	19.5 acres at Savage Possible minor intrusions in confined areas Shuttle maintenance facility required in Eielson for Wonder Lake segment
Wildlife, Vegetation, Water, Soils, Air	Healing of existing road edge habitat by elimination of dust and grading Significantly fewer vehicle events would decrease wildlife disturbance Activity at two-way rest stops would cause habitat disturbance due to social trail formation and noise Larger fuel storage requirements at terminals and increased potential for spills	Healing of existing road edge habitat by elimination of dust and grading Significantly fewer vehicle events would decrease wildlife disturbance Social trail development at staging area, soil erosion Activity at two-way rest stops would cause habitat disturbance due to social trail formation and noise Larger fuel storage requirements at terminals and increased potential for spills Permanent fragmentation of pristine park habitat Increased potential for poaching Impacts on vegetation in Stampede corridor	Healing of existing road edge habitat by elimination of dust and grading Significantly fewer vehicle events would decrease wildlife disturbance Social trail development at staging area, soil erosion Activity at two-way rest stops would cause habitat disturbance due to social trail formation and noise Larger fuel storage requirements at terminals and increased potential for spills
Cultural		Probable disturbance to archeological and historic disturbance in Kantishna and along the Stampede Road corridor	
Construction Impacts	Impacts in and outside park from gravel extraction and importation activities Water quality impacts, noise, equipment emissions, and dust would occur from construction staging Two seasons of wildlife disturbance and displacement during construction Construction could be slowed by wildlife migration, archeological sites, and other environmental concerns Construction crew housing required	Impacts in and outside park from gravel extraction and importation activities for two major projects Water quality impacts, noise, equipment emissions, and dust would occur from construction staging in Park road and Stampede corridors Two seasons of wildlife disturbance and displacement during construction in park road and Stampede corridors Construction could be slowed by wildlife migration, archeological sites, and other environmental concerns Construction crew housing required for two separate projects	Impacts in and outside park from gravel excavation and importation activities Water quality impacts, noise, equipment emissions, and dust would occur from construction staging Two seasons of wildlife disturbance and displacement during construction Construction could be slowed by wildlife migration, archeological sites, and other environmental concerns Construction crew housing required
Consistency with Park Service and Regional Planning Goals			
Park Management	Reservation system required for efficient operation Turnkey operation possible Requires assessment of NPS user fee policy More control over Kantishna access	Reservation system required for efficient operation Turnkey operation possible Requires assessment of NPS user fee policy Major development pressures in Kantishna Major new area to patrol for resource protection and visitor needs	Reservation system required for efficient operation Turnkey operation possible Requires assessment of NPS user fee policy More control over Kantishna access
Offsite Impacts	Major hotel demand increase (85%) Major gravel source and delivery requirements	Major hotel demand increase (85%) Major gravel source and delivery requirements for two separate projects Residential area in Eight Mile Lake impacted with additional Stampede Road traffic Development pressure in Wolf Townships	Major hotel demand increase (45%) Major gravel source and delivery requirements
Cost and Cost Effectiveness			
Construction and Equipment Costs	$314.5 million (24 cog vehicles, 7 buses)	$482.4 million (24 cog vehicles, 7 buses)	$413.5 million (26 cog vehicles, 4 buses)
Annual Operating and Maintenance Costs	$2.7 million	$3.1 million	$3.1 million
Amortized Cost/Visitor	$61.64	$94.72	$88.69
Implementation			
Compliance Issues	Major controversial EIS and design effort for staging area and rail alignment DCP/EA for related facilities and any gravel extraction	Major controversial EIS and design effort for staging area, rail alignment, and Stampede alignment DCP/EA for related facilities and any gravel extraction Requires wilderness management exemption	Major controversial EIS and design effort for staging area and rail alignment DCP/EA for related facilities and any gravel extraction
Number of Employees	New transit mode requires specialized labor Probable increase in ranger and interpretative staff needed for higher visitation levels 99 transportation employees	New transit mode requires specialized labor Probable increase in ranger and interpretative staff needed for higher visitation levels Additional maintenance staff required for Stampede Road 114 transportation employees	New transit mode requires specialized labor Probable increase in ranger and interpretative staff needed for higher visitation levels 106 transportation employees


DENALI NATIONAL PARK AND PRESERVE BOUNDARY
TO DENALI NATIONAL PARK & PRESERVE HEADQUARTERS & FAIRBANKS
ALDER POINT TRAMWAY SUMMIT
UPPER TRAMWAY ROUTE TO ALDER POINT
TRANSFER TERMINAL BETWEEN TRAMWAY SECTIONS
LOWER TRAMWAY ROUTE TO MIDPOINT
TRAMWAY BASE TARGET AREA
TRAMWAY BASE ADJACENT TO GEORGE PARKS HIGHWAY
EXISTING TRACTOR TRAIL
GEORGE PARKS HIGHWAY (STATE RT 3)
DENALI STATE PARK BOUNDARY
TO ANCHORAGE
BLAIR LAKE

SOUTH SLOPE AERIAL TRAMWAY ALTERNATIVE INFORMATION SUMMARY

Alder Point Terminal From George Parks Highway
- Horizontal Distance = 29,040 Ft (5.5 Miles)
- Requires Two Tramway Sections with Transfer Terminal
- Vertical Rise = 3,670 Ft
- Tower Requirements = 5-10
- Cabin Size = 100 Passenger Capacity
- Operating Speed = 16 Ft / Sec. (11 MPH) to 32 Ft / Sec. (22 MPH)
- One-way Time = 15 to 30 Minutes
- Round Trip Time = 30 to 60 Minutes
- Trips per Hour = 2 to 4
- Daily Operating Duration = 12 Hours
- Daily Capacity = 2,400 to 4,800 Passengers
- Parking Requirements = 1.6 to 2.2 Acres (Assuming 50% of Passengers Arrive By Tour Shuttle or Other Transport)
- Additional Platform and Parking Requirements Required for Visitors Arriving by Bus

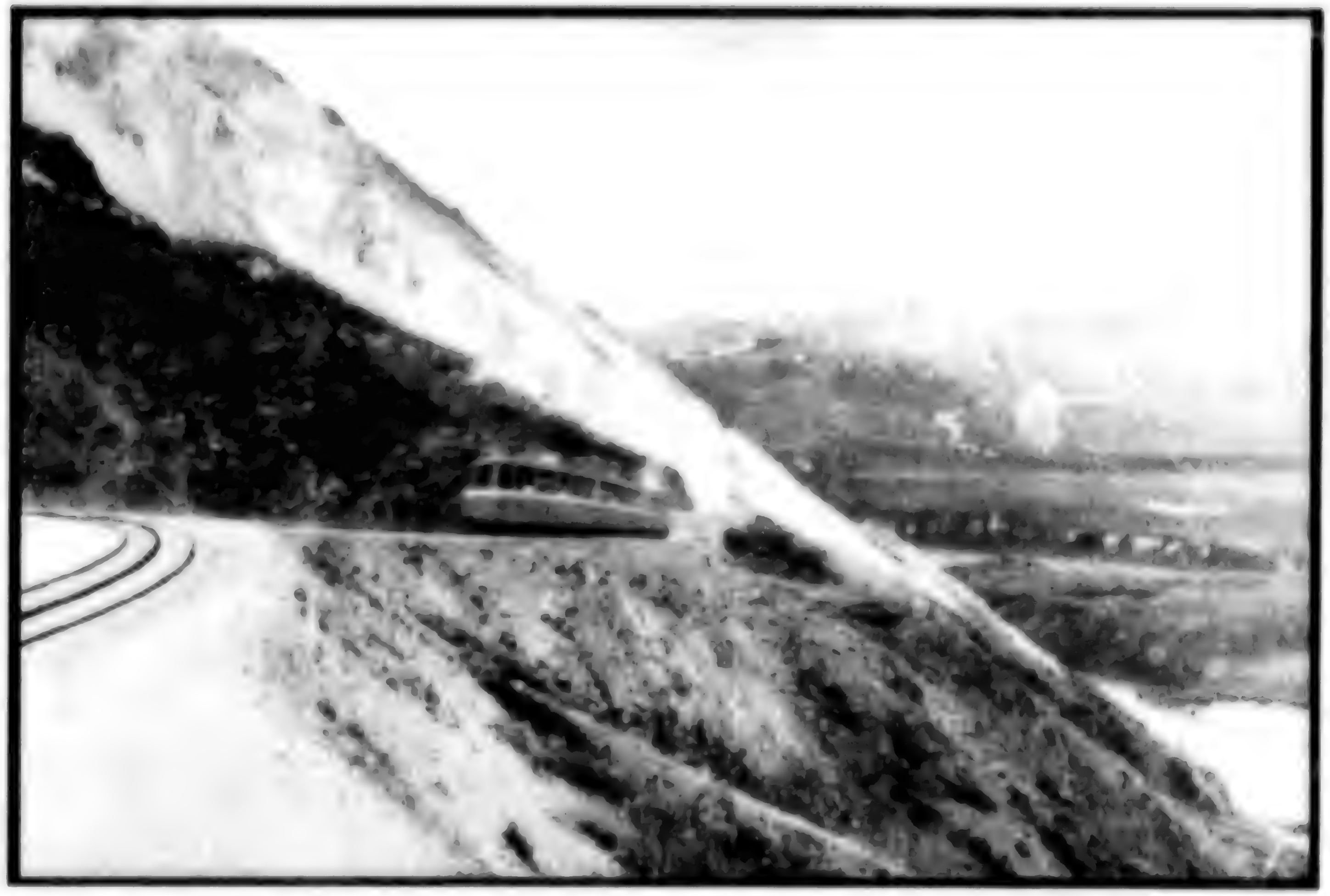
DENALI
NATIONAL PARK AND PRESERVE
ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY
UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE DSC / JUL 93 / 184 / 20079A

EVALUATION SUMMARY CHART

SOUTH SLOPE TRAMWAY VTS ALTERNATIVE

	Tramway to Alder Point
Visitor Transportation and Management	
Daily Visitors Served	2,400 - 4,800 daily passengers Could potentially reduce visitation demand along park road corridor
Visitor Experience	
Views	Mt. McKinley, Ruth Glacier, and Tokosha Mountains views Wildlife viewing from above Views from road disrupted by towers
Other	Easy access from Anchorage Distinct experience
Resource Impact	
Wilderness Encroachment	New corridor into undisturbed area Total length = 3.5 miles, 8 to 10 towers Evacuation staging area requirements along alignments
Wildlife, Vegetation, Soil, and Water	Activity at tram staging areas would induce social trail development and localized wildlife disturbance from human activity Potential effects to raptors and birds at Chulitna River Impacts from transmission of power Effects to aesthetic qualities of undisturbed wilderness 2.2 acres of parking required
Construction Impacts	Construction would impact wildlife, vegetation, and possibly archeological resources Sedimentation during construction could impact fisheries and aquatic habitat One season of wildlife disturbance and displacement would occur Sensitive construction methods could extensively reduce impacts
Consistency with Park Service & Regional Goals	
Park Management	Reservation system required for efficient operation New area for major public use Additional staff requirements for interpretation and visitor assistance responsibilities
Off-Site Impacts	Development pressure in Denali State Park and Talkeetna New power source requirements
Cost and Cost Effectiveness	
Construction and Equipment Costs	$87.2 Million (2 sections, 3 terminals, 4 passenger cabins)
Annual Operating and Maintenance Costs	$667,000
Annualized Cost/Visitor	$28.88
Associated Power Source Costs (Included in construction and equipment costs)	Required access to Anchorage/Fairbanks tie line Approximate 15-mile construction of distribution line ($100,000/mile); 30 to 40 ft. right-of-way likely required for distribution line Substation required at a cost in the range of $1.5 million
Implementation	
Compliance Issues	EIS required for construction and permanent changes to wilderness area Coordination with Denali State Park Requires wilderness management exemption
Number of Employees	29 transportation employees

EXISTING TRANSPORTATION SYSTEM
ON POLYCHROME PASS
DSC/JUL 93/184/20085A



SIMULATION OF COG RAILWAY ALTERNATIVE
ON POLYCHROME PASS
DSC/JUL 93/184/20086A

IMPLEMENTATION ISSUES

The next step in implementing improved visitor transportation systems at Denali would be the development of an initial program management plan. This plan would set forth the planning, design, and environmental compliance steps necessary to define a preferred solution and to gain the necessary approvals for the preferred alternative. The plan would also lay out a process for identifying the required funding for the project and a financing plan. The plan would include a schedule and would identify responsibilities for each stage in the implementation program, beginning with more in-depth planning studies and ending with the construction of new facilities and operation of the new system.

The following paragraphs identify the key elements of a program management plan for an improved Denali visitor transportation system. The plan elements follow the basic approach used in the development of federally funded urban transit systems and could form the basis of a standard NPS process for identifying and evaluating servicewide VTS needs.

CONCEPTUAL ENGINEERING/ ALTERNATIVES ANALYSIS

This initial stage of the implementation process would compile information on existing topography, soils, environmental baseline conditions, and other material to support the conceptual design of each alternative and the preliminary evaluation of the environmental impacts of the alternatives. Plan and profile drawings would be developed for any rail alternatives, needed roadway improvements would be identified for bus alternatives and a detailed operating plan would be developed for each. The location, size, and type of visitor facilities, maintenance facilities and other features identified in this study would be refined and conceptual layouts would be produced. Operational tests of alternative buses should be undertaken to identify the most appropriate models for use on the park road.

Visitor use projections would be developed and conceptual cost estimates would be compared to identify the most cost-effective options. The environmental impacts of the construction and operation of each alternative would be estimated and compared, along with assessments of each alternative's contribution to the visitor experience and the achievement of park objectives.

The relationship between the transportation of visitors and the carrying capacity of park resources is an extremely important element of the evaluation of the alternatives. Carrying capacity should be considered from the perspective of physical damage to natural and cultural resources and from the viewpoint of the visitor experience. The contribution of each transportation alternative to the wilderness aspect of the Denali experience and the sense of adventure that the current system offers will be significant to the ultimate choice among the available options. An important input to the evaluation of transportation options would be the physical carrying capacity of the various elements of the park environment that will be subjected to concentrations of visitor use. The need for, feasibility of, and acceptability of improvements needed to manage visitor use at the rest areas, Eielson Visitor Center, and other areas of concentrated use should be considered as an integral part of the evaluation of alternatives.

The product of this step in the process would be a definition of the preferred alternative for the park, a more definitive cost estimate for the system, and a preliminary financing plan. This information could be used to compare proposed improvements at Denali with other servicewide needs to develop priorities for NPS funding allocations.

Depending on the alternative selected to address Denali's visitor transportation needs, additional design and environmental compliance efforts may be required. The remaining portion of this section describes possible implementation steps for a cog rail or other fixed-guideway transit system. Bus alternatives that use the existing park road would not require the same implementation steps.

PRELIMINARY ENGINEERING/ ENVIRONMENTAL IMPACT STATEMENT

In this step of the process, the design of the proposed improvements would be developed in more detail to confirm the alignment, profile, requirements for structures, and the location and design of fixed facilities. Approximately 30% of the design work needed to produce construction contract documents would be completed at this stage of the project. Performance specifications would be prepared for the equipment needed to operate the visitor transportation system.

The greater level of detail available at this stage of the design process would allow environmental impacts of the proposed improvements to be determined with confidence, and would permit mitigation measures to be identified and included in the design. An environmental impact statement would be prepared during this step in the process. Cost estimates prepared at this stage would have a greater level of confidence.

FINAL DESIGN, CONSTRUCTION, OPERATIONS

At this stage of the project development process, a number of options would be available for moving the project forward if the necessary funding were secured. Adequate project definition would now be available to turn all or portions of the project over to a contractor or set of contractors, if that approach offered significant advantages with respect to cost or implementation time. The implementation strategy could follow one of four models:

- traditional model
- design/build model
- turnkey model
- super turnkey model

Traditional Project Implementation

The traditional approach to developing public works projects has involved separating the final design and construction tasks from one another. Construction documents and detailed equipment specifications for all elements of the project are prepared under the direction of the project owner. The project is split into packages, and competitive bids are taken for constructed facilities and for equipment items. In some cases, a single, all-encompassing general contract is bid, but more often a number of individual elements of the project are bid separately. The owner or a representative of the owner is then responsible for coordinating the work of the individual contractors.

Design-Build

The design-build model for project development involves splitting the project into distinct packages at the completion of preliminary engineering. Competitive bids are taken for the completion of design and construction of fixed facilities based on the preliminary engineering design and for the design and manufacture of equipment based on a performance specification. This approach potentially allows the contractors to contribute to the design process, perhaps identifying cost-saving design changes. This approach also internalizes any conflicts between the design intent and any unexpected conditions that are revealed during construction within a single contracting entity. The owner is still responsible for coordinating the activities of the different contractors to deliver a completed project.

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Turnkey

The turnkey contracting model involves taking competitive bids on a single contract package that includes all the elements necessary to deliver the completed project. The turnkey contract also may include the operation of the completed project for a specified number of years. The presumed advantage of this approach is that a single point of responsibility is identified for delivering a completed, successful project. The risk of coordinating the elements of the project is removed from the owner and placed on the contractor. Turnkey contracts usually are based on a firm fixed price for which the contractor agrees to deliver the finished project. While risk is transferred to the contractor, the owner gives up a good deal of control over the process in this model.

Super-Turnkey

The super-turnkey model can be used if the contractor has a potential ownership interest in all or portions of the system. Within the National Park Service, the development of fixed facilities within park units by concessioners is a form of super-turnkey project implementation. In the case of a VTS project, a park concessioner could undertake the project on a super-turnkey basis. The concessioner could retain ownership of the system for a specified number of years and have the rights to operate the system, collecting fares and using the system to support other concession services. The Park Service could share in system revenues through provisions in the super-turnkey contract. Alternatively, the Park Service could agree to subsidize the concessioner operation of the system to keep user costs low.

Turnkey and super-turnkey project implementation has received a great deal of interest in the last few years. Transit proposals involving these innovative approaches include systems in the twin cities, Newark, Houston and Honolulu. To date, a transit project has not been completed using the turnkey or super-turnkey approach.

In Denali, each of the available approaches has advantages and drawbacks. At the feasibility study stage, it is not necessary to identify a preferred approach. If a VTS project proceeds into preliminary engineering, a formal evaluation of the available implementation strategies should be made. Factors to consider in choosing an approach include the cost of the project, the degree of risk and liability, and the way in which risk is shared among the parties. Other factors include, the degree of control which the Park Service can exercise over the project, the time schedule for completion of the project, the quality of the resulting system, the Park Service's ability to manage the project, and other factors specific to Alaska and Denali National Park and Preserve.

STAGED IMPROVEMENT TO DENALI VTS SERVICES

Recognizing the length of time required to implement major projects within the parks and considering the recent history of visitation growth at Denali, the need for a phased program of VTS improvements is apparent. Refinements to the existing visitor transportation services should be made soon to address existing needs. Over time, new equipment can be acquired for use in the existing mix of services while more in-depth planning and engineering work is undertaken to identify the best long-term solution. Equipment that is purchased for use in Denali can most likely be used in other Alaska parks or elsewhere in the national park system if a different technology is implemented at a future date.

A strategy that begins with operational improvements to the existing system, continues with equipment upgrades, and perhaps concludes with the development of a rail system along the park road or a south slope aerial tram would serve the park's current needs while providing for long-range growth. This strategy would allow a decision regarding the long-range future to be deferred until more detailed studies can be completed and a service-wide policy and funding program for NPS visitor transportation systems is formulated.

FUNDING OPTIONS

The potential funding sources for VTS improvements at Denali include annual appropriations as part of the park's operating budget (the current situation), programs within the Intermodal Surface Transportation Efficiency Act, a new and as yet undefined NPS program for visitor transportation systems, the state of Alaska (which has identified Denali as a crucial factor in statewide tourism), the park visitors (in the form of entrance fees or fares), and the private sector. The private sector's involvement would be predicated on the potential to recover their investment through user charges and/or subsidies.

The annualized cost of the alternatives ranges from $5 million for an upgraded standard bus fleet, to approximately $28 million for the most economical cog rail alternative. This compares to a 1992 contract amount of $1.7 million for NPS shuttle services at Denali and an annual cost to the concessioner for tour services, which is likely to be of similar magnitude, plus road maintenance costs of $500,000 per year. The annualized cost of all current VTS-related activities at Denali is probably less than $4 million.

The likelihood of securing funding for the cog railway alternative is low considering current policies and funding sources. However, on a per-passenger basis, the overall cost of the system does not seem unreasonable, especially considering the fares paid by ARA wilderness tour riders. This conclusion depends on the validity of the assumed annual visitation of 400,000 per year.

Currently, a service-wide policy regarding VTS system development and funding is not in place. The need for such a policy is evident from the results of this study and the companion efforts at Yosemite and Yellowstone national parks. The funding required to support any of the proposed alternatives is beyond the current resources of Denali National Park. No formal VTS program currently exists to address visitor transportation needs at Denali or other units of the National Park System. Decisions at Denali and other parks are made on an individual basis, considering the availability of funds and competing needs in each park.

The movement of visitors is one of the most significant aspects of the management of the nation's park units. This study and other ongoing work in the parks have identified the importance of the Park Service's role in planning for and managing visitor use. Visitor transportation systems offer a means to manage visitor movements while enhancing the interpretation of park resources and enjoyment of the visitors. Systems that complement private vehicle travel are most appropriate in areas of high use or special resource sensitivity, like Denali. The successful operation of a mandatory visitor transportation system at Denali over a period of 20 years serves as a model for other parks that are considering how to provide for visitor enjoyment while preserving those special aspects of the park that caused them to be set aside as national treasures. The Denali case provides eloquent proof that visitors can leave their cars behind and not miss them.

Volume I of the *Alternative Transportation Modes Feasibility Study* contains a more in-depth discussion of these issues and the question of VTS program needs within the Park Service. It is apparent that alternative transportation modes are not only a feasible alternative to private vehicle travel, but a superior option for visitors and the Park Service in a number of park settings.

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Notes:

1. *Management Policies*, National Park Service, 1988.

2. Source: Denali National Park and Preserve staff.

3. Wahrhaftig (Geological Survey 1965).

4. "Caribou Reactions to Traffic and Construction along the Denali Road," J. Beattie, 1986; and "Wildlife viewing and the Mandatory Public Transportation System in Denali National Park," Singer and J.Beattie, 1984.

5. "Caribou Reactions to Traffic and Construction along the Denali Road," J. Beattie, 1986.

6. *Management Policies*, National Park Service, 1988.

7. "The Wolves of Mt. McKinley," Adolf Murie, 1944

8. Typical peak day bus trips plus the sum of average daily trips in the 1992 peak month for each other trip type.

9. Further detailed engineering analysis will be needed to confirm the alignment of all alternatives except those that use the existing road surface for movement of vehicles.

10. Electrification requirements source: Dave Johnson, New Services Representative, Golden Valley Power, Anchorage, Alaska

Appendix 1: Roadway Segment-by-Segment Issues From Existing Transportation System

SEGMENT-BY-SEGMENT ISSUES FROM THE EXISTING TRANSPORTATION SYSTEM

In general, these segments represent physiographic divisions or watersheds and subsequently more site-specific habitats. Segments of road are identified by geographic location and corresponding mile marker. The issues are listed with regard to their priority on the basis of location of disturbance and resource significance.

1) Riley Creek/Park Headquarters (MP 1 - 8)

Summary of Issues -

Habitat fragmentation and habitat removal for new development
Wildlife disturbance including moose calving and grizzly hunting
Auto/bus/pedestrian activity including significant private auto/visitor activity
Visual inconsistencies in structures and signage
Historic Sites in the headquarters area
Erosion/sedimentation effects on Jenny Creek stream water quality

2) Savage River Segment (MP 8 - 19)

Summary of Issues -

Wildlife disturbance with Dall sheep migration and moose use
Auto/pedestrian activity and vehicular speeds
Erosion/sedimentation effects on Jenny Creek stream water quality
Permafrost, silt and clay soils locations

- MP 15 to MP 15.5 (permafrost)
- MP 17 to MP 19 (silt and clay)

3) Sanctuary River Segment (MP 19 - 24)

Summary of Issues -

Auto/pedestrian activity including vehicle speeds in closed forest through the Sanctuary River corridor, and effects of "social trails" on soil, habitat, wildlife
Dust - vegetation coating, air quality, and aesthetic effects
Habitat/Wildlife disturbance including Dall sheep migration, forest Fragmentation/bird nesting, River/wildlife corridor crossing
Erosion/sedimentation effects on Sanctuary River Water Quality

4) Teklanika River Segment (MP 24 - 34)

Summary of Issues -

Auto/pedestrian activity including Vehicle speeds in closed forest
Dust - vegetation coating, air quality, and aesthetic effects
Habitat/Wildlife disturbance including broad river corridor crossing for many species
Significant cultural resources including Teklanika Cultural Resource District
Erosion/sedimentation effects on Teklanika River Water Quality
Frost and silt and clay soil locations

- MP 31 to MP 34

5) Igloo Creek Segment (MP 34 - 39)

Summary of Issues -

- Effects to Igloo Creek riparian habitat/water quality/stream hydrology
- Auto/Pedestrian activity in the vicinity of Igloo Creek Campground including social trails
- Dust - vegetation coating, air quality, and aesthetic effects
- Ice removal impacts

6) Sable Pass Segment (MP 39 - 43)

Summary of Issues -

- Wildlife disturbance including critical bear/sow/cubs use area, and Dall sheep rutting
- Views of Denali from Sable Pass
- Historic structures for potential listing on Historic Register
- Dust - air quality, aesthetic, and vegetation coating effects
- Erosion/sedimentation from exposed roadside cut and fill slopes
- Silt and clay soil locations
    - MP 40 to MP 42

7) Polychrome Pass Segment (MP 43 - 48)

Summary of Issues -

- Pedestrian/maintenance activity including effects of "social trails" on tundra soil, vegetation, wildlife
- Significant panoramic views
- Ice lenses/permafrost locations adjacent to rest stop area

8) Toklat River Segment (MP 48 - 59)

Summary of Issues -

- Auto/maintenance equipment/pedestrian activity including employee housing, maintenance operations in significant wildlife use area
- Wildlife disturbance to Dall sheep migration, Bear mating/hunting, and Caribou migration
- Dust - air quality, aesthetic, minimal vegetation coating effects
- Erosion/sedimentation from some exposed roadside cut and fill slopes
- Changes to roadside vegetation growth patterns
- Effects to pristine wilderness image from gravel excavation
- Silt-clay soil locations
    - MP 53 to MP 54

9) Highway to Thorofare Pass Segment (MP 59 - 65)

Summary of Issues -

- Wildlife disturbance including Caribou migration, Bear use near Highway Pass from traffic
- Significant views from Denali overlook at Stony Hill (MP 62)
- Dust - air quality, aesthetic effects
- Erosion/sedimentation at three drainage crossings

10) Eielson Visitor Center Segment (MP 65 - 69)

Summary of Issues -

Pedestrian activity including effects of "social trails" on tundra soil, vegetation
Wildlife disturbance including Caribou migration, wintering sheep
Significant panoramic views of Denali
Silt-clay soils and frost locations
- MP 60 to MP 69

11) McKinley River to Wonder Lake Segment (MP 69 - 88)

Summary of Issues -

Pedestrian activity at Wonder Lake Campground including effects of "social trails" on soil, habitat, wildlife
Habitat/Wildlife disturbance including Bird nesting, use areas, Caribou migration
Sedimentation and disturbance to wetlands, beaver ponds, moose use areas
Significant views of Denali, Muldrow Glacier
Silt-clay soils, freeze/thaw locations
- MP 70 to MP 88

12) Kantishna Segment (MP 88 - 92)

Summary of Issues -

Erosion/Sedimentation effects on water quality primarily into Moose Creek from Unstable cut and fill slopes, Exposed soils at the edges of parking lots, storage areas, trails, roads and mining
Tundra and riparian habitat fragmentation, damage, and removal from development growth
Auto, equipment pedestrian activity wildlife disturbance
Effects to pristine/wilderness character
Effects to historic mining structures

Appendix 2: Denali Transit Alternatives Cost Estimate Summaries and Methologies

Denali Transit Alternative Cost Estimates
Alternative: 52 Passenger Bus, No Stampede Road

Capital Costs

Item	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	62 Std. Bus	$151,500	$9,393,000	$1,502,880	$10,895,880	$0	$10,895,880
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Transit Alignment			NA		NA		NA
Maintenance Facility	62 Veh.	$76,000	$4,712,000	$1,460,720	$6,172,720	$1,178,000	$ 350,720
Fuel Storage Tank(s)	10,000 Gallons	$2.50	$25,000	$7,750	$32,750	$6,250	$39,000
Utility Vehicles			NA			NA	
Parking							
--Auto	507 Spaces	$1,500	$760,500				
--RV	213 Spaces	$3,225	$686,925				
Total	720 Spaces		$1,447,425	$448,702	$1,896,127	$361,856	$2,257,983
Passenger Facilities							
--Platform Decking (Uncovered)	13,820 S.F.	$10	$138,200	$42,842	$181,042	$34,550	$215,592
-- Timber Shelters W/Decking (Savage, Rest Stops)	4,180 S.F.	$100	$418,000	$129,580	$547,580	$104,500	$652,080
Total Capital Costs			**$16,158,625**	**$3,596,474**	**$19,755,099**	**$1,685,156**	**$21,440,255**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	143 Empl.	Varies	$2,198,418
Maintenance of Way	15 Empl.	Budget	$500,000
Fuel Consumption ($1.50/Gal.) --Std. Bus (6 mpg)	875,057 Miles	$0.25	$218,764
Parts & Preventative Maintenance	875,057 Miles	$0.25	$218,764
Overhead for Maintenance Facil.	1 Facil.	$25,000	$25,000
Total Oper. & Maint. Costs			**$3,160,947**

Annualized Cost Per Visitor
(7% Compound Interest)

	Total Costs	Life (Yrs)	Annualized
Facilities	$10,515,375	30	847,396
Equipment	$10,924,880	15	1,199,493
Operation and Maintenance	$3,160,947	NA	$3,160,947
Total Annualized Cost			$5,207,836
Total Annual Visitors			279,831
Annual Cost/Visitor			**$18.61**

Notes:
- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

Denali Transit Alternative Cost Estimates

Alternative: 52 Passenger Bus, With Stampede Road

Capital Costs

	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	75 Std. Bus	$151,500	$11,362,500	$1,818,000	$13,180,500	$0	$13,180,500
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Transit Alignment			NA		NA		NA
Construction of Stampede Road	Estimate		$107,773,957	$33,409,927	$141,183,884	$26,943,489	$168,127,373
Maintenance Facility	75 Veh.	$76,000	$5,700,000	$1,767,000	$7,467,000	$1,425,000	$8,892,000
Fuel Storage Tank(s)	13,000 Gallons	$2.50	$32,500	$10,075	$42,575	$8,125	$50,700
Parking							
– Auto	604 Spaces	$1,500	$906,000				
– RV	254 Spaces	$3,225	$819,150				
Total	858 Spaces		$1,725,150	$534,797	$2,259,947	$431,288	$2,691,234
Passenger Facilities							
– Platform Decking (Uncovered)	17,780 S.F.	$10	$177,800	$55,118	$232,918	$44,450	$277,368
– Timber Shelters W/Decking (Savage, Rest Stops)	4,980 S.F.	$100	$498,000	$154,380	$652,380	$124,500	$776,880
Total Capital Costs			**$127,294,907**	**$37,753,296**	**$165,048,203**	**$28,976,852**	**$194,025,055**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	172 Empl	Varies	$2,651,437
Maintenance of Way	36 Empl	Budget x 2	$1,000,000
Fuel Consumption ($1.50/Gal.) – Std. Bus (6 mpg)	1,160,905 Miles	$0.25	$290,226
Parts & Preventative Maintenance	1,070,329 Miles	$0.25	$267,582
Overhead for Maintenance Facil.	1 Facil.	$25,000	$25,000
Total Oper. & Maint. Costs			**$4,234,245**

Annualized Cost Per Visitor

(7% Compound Interest)

	Total Cost	Life (Yrs)	Annualized
Facilities	$180,815,555	30	$14,571,275
Equipment	$13,209,500	15	$1,450,332
Operation and Maintenance	$4,234,245	NA	$4,234,245
Total Annualized Cost			$20,255,853
Total Annual Visitors			341,103
Annual Cost/Visitor			**$59.38**

Notes:
- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

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Denali Transit Alternative Cost Estimates

Alternative: 72 Passenger Bus, No Stampede Road

Capital Costs

Item	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	59 Lg. Bus	$345,000	$20,355,000	$3,256,800	$23,611,800	$0	$23,611,800
	4 Std. Bus	$151,500	$606,000	$96,960	$702,960	$0	$702,960
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Transit Alignment			N/A		N/A		N/A
Maintenance Facility	62 Veh.	$83,600	$5,183,200	$1,606,792	$6,789,992	$1,295,800	$8,085,792
Fuel Storage Tanks(s)	18,000 Gallons	$2.50	$45,000	$13,950	$58,950	$11,250	$70,200
Utility Vehicles			NA		NA		NA
Parking							
– Auto	684 Spaces	$1,500	$1,026,000				
– RV	288 Spaces	$3,225	$928,800				
Total	972 Spaces		$1,954,800	$605,988	$2,560,788	$488,700	$3,049,488
Passenger Facilities							
– Platform Decking (Uncovered)	19,460 S.F.	$10	$194,600	$60,326	$254,926	$48,650	$303,576
– Timber Shelters W/Decking (Savage, Rest Stops)	5,530 S.F.	$100	$553,000	$171,430	$724,430	$138,250	$862,680
Total Capital Costs			**$28,916,600**	**$5,816,246**	**$34,732,846**	**$1,982,650**	**$36,715,496**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	146 Empl.	Varies	$2,211,316
Maintenance of Way	16 Empl.	Budget	$500,000
Fuel Consumption ($1.50/Gal.)			
– Lg. Bus (3 mpg)	769,785 Miles	$0.50	$384,893
– Std. Bus (6 mpg)	96,348 Miles	$0.25	$24,087
Parts & Preventative Maintenance	866,133 Miles	$0.25	$216,533
Overhead for Maintenance Facil.	1 Facil.	$25,000	$25,000
Total Oper. & Maint. Costs			**$3,361,829**

Annualized Cost Per Visitor

(7% Compound Interest)

	Total Cost	Life (Yrs)	Annualized
Facilities	$12,371,736	30	$996,994
Equipment	$24,343,760	15	$2,672,701
Operation and Maintenance	$3,361,829	NA	$3,361,829
Total Annualized Cost			$7,031,524
Total Annual Visitors			399,045
Annual Cost/Visitor			**$17.62**

Notes
- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.
- Maintenance Facility Cost Per Unit increased by 10% over cost for standard bus maintenance facility to represent accommodations for large bus. Double decker buses assumed for maintenance facility estimate. Requirements for articulated buses may differ.

Denali Transit Alternative Cost Estimates

Alternative: 72 Passenger Bus, With Stampede Road

Capital Costs

Item	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	66 Lg. Bus	$345,000	$22,770,000	$3,643,200	$26,413,200	$0	$26,413,200
	4 Std. Bus	$151,500	$606,000	$96,960	$702,960	$0	$702,960
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Transit Alignment			NA		NA		NA
Construction of Stampede Road	Estimate		$107,773,957	$33,409,927	$141,183,884	$26,943,489	$168,127,373
Maintenance Facility	70 Veh.	$83,600	$5,852,000	$1,814,120	$7,666,120	$1,463,000	$9,129,120
Fuel Storage Tank(s)	22,000 Gallons	$2.50	$55,000	$17,050	$72,050	$13,750	$85,800
Utility Vehicles							
Parking							
- Auto	756 Spaces	$1,500	$1,134,000				
- RV	318 Spaces	$3,225	$1,025,550				
Total	1,074 Spaces		$2,159,550	$669,461	$2,829,011	$539,888	$3,368,899
Passenger Facilities							
- Platform Decking (Uncovered)	25,040 S.F.	$10	$250,400	$77,624	$328,024	$62,600	$390,624
- Timber Shelters W/Decking (Savage, Rest Stops)	6,630 S.F.	$100	$663,000	$205,530	$868,530	$165,750	$1,034,280
Total Capital Costs			**$140,154,907**	**$39,937,871**	**$180,092,778**	**$29,188,477**	**$209,281,255**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	163 Empl.	Varies	$2,473,734
Maintenance of Way	36 Empl.	Budget x 2	$1,000,000
Fuel Consumption ($1.50/Gal.)			
- Lg. Bus (3 mpg)	959,173 Miles	$0.50	$479,587
- Std. Bus (6 mpg)	96,348 Miles	$0.25	$24,087
Parts & Preventative Maintenance	980,041 Miles	$0.25	$245,010
Overhead for Maintenance Facil.	1 Facil.	$25,000	$25,000
Total Oper. & Maint. Costs			**$4,247,418**

Annualized Cost Per Visitor

(7% Compound Interest)

	Total Cost	Life (Yrs)	Annualized
Facilities	$182,136,095	30	$14,677,693
Equipment	$27,145,160	15	$2,980,383
Operation and Maintenance	$4,247,418	NA	$4,247,418
Total Annualized Cost			$21,905,503
Total Annual Visitors			444,000
Annual Cost/Visitor			**$49.34**

Notes:
- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.
- Maintenance Facility Cost Per Unit increased by 10% over cost for standard bus maintenance facility to represent accommodations for large bus. Double decker buses assumed for maintenance facility estimate. Requirements for articulated buses may differ.

Denali Transit Alternative Cost Estimates

Alternative: 216 Passenger Cog Rail to Eielson, Replacing Rd, No Stampede Road

Capital Costs

Item	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	24 Train	$5,250,000	$126,000,000	$20,160,000	$146,160,000	$0	$146,160,000
	7 Std. Bus	$151,500	$1,060,500	$169,680	$1,230,180	$0	$1,230,180
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Transit Alignment	Estimate		$97,192,821	$30,129,775	$127,322,596	$24,298,205	$151,620,801
Maintenance Facility (Savage)	24 Train	$240,000	$5,760,000	$1,785,600	$7,545,600	$1,440,000	$8,985,600
Maintenance Facility (Eiel/WI)	1,500 S.F	$579	$868,500	$269,235	$1,137,735	$217,125	$1,354,860
Fuel Storage Tank(s) (High)	35,000 Gallons	$2.50	$87,500	$27,125	$114,625	$21,875	$136,500
Utility Vehicles	Estimate		$100,000	$31,000	$131,000	$25,000	$156,000
Parking							
--Auto	859 Spaces	$1,500	$1,288,500				
--RV	318 Spaces	$3,225	$1,025,550				
Total	1,177 Spaces		$2,314,050	$717,356	$3,031,406	$578,513	$3,609,918
Passenger Facilities							
- Platform Decking (Uncovered)	11,000 S.F	$10	$110,000	$34,100	$144,100	$27,500	$171,600
- Timber Shelters W/Decking (Savage, Rest Stops)	6,520 S.F	$100	$652,000	$202,120	$854,120	$163,000	$1,017,120
Total Capital Costs			**$234,170,371**	**$53,529,990**	**$287,700,361**	**$26,771,218**	**$314,471,579**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	81 Empl	Varies	$1,151,216
Maintenance of Way	18 Empl	Budget	$500,000
Fuel Consumption ($1.50/Gal.)			
- Train (.5 mpg)	259,829 Miles	$3.00	$779,486
- Std. Bus (6 mpg)	127,583 Miles	$0.25	$31,896
Parts & Preventative Maintenance			
- Train	259,829 Miles	$0.50	$129,914
- Bus	127,583 Miles	$0.25	$31,896
Overhead for Maintenance Facil	3 Facil	$25,000	$75,000
Total Oper. & Maint. Costs			**$2,699,409**

Annualized Cost Per Visitor

(7% Compound Interest)

	Total Cost	Life (Yrs)	Annualized
Facilities	$166,896,399	30	$13,449,581
Equipment			
--Cog Vehicles	$146,160,000	30	$11,778,509
--Buses Etc	$1,415,180	15	$155,379
Operation and Maintenance	$2,699,409	NA	$2,699,409
Total Annualized Cost			$28,082,877
Total Annual Visitors			444,000
Kantishna Visitors			11,433
Total Visitors			455,433
Annual Cost/Visitor			**$61.66**

Notes:
- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

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Denali Transit Alternative Cost Estimates

Alternative: 216 Passenger Cog Rail to Eielson, Replace Rd. With Stampede Road

Capital Costs

Item	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	24 Train	$5,250,000	$126,000,000	$20,160,000	$146,160,000	$0	$146,160,000
	7 Std. Bus	$151,500	$1,060,500	$169,680	$1,230,180	$0	$1,230,180
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Transit Alignment	Estimate		$97,192,821	$30,129,775	$127,322,596	$24,298,205	$151,620,801
Construction of Stampede Road	Estimate		$107,773,957	$33,409,927	$141,183,884	$26,943,489	$168,127,373
Maintenance Facility (Savage)	24 Train	$240,000	$5,760,000	$1,785,600	$7,545,600	$1,440,000	$8,985,600
Maintenance Facility (Eiel/WL)	1,500 S.F.	$579	$868,500	$269,235	$1,137,735	$217,125	$1,354,860
Fuel Storage Tank(s)	33,000 Gallons	$2.50	$82,500	$25,575	$108,075	$20,625	$128,700
Utility Vehicles	Estimate		$100,000	$31,000	$131,000	$25,000	$156,000
Parking							
- Auto	764 Spaces	$1,500	$1,146,000				
- RV	318 Spaces	$3,225	$1,025,550				
Total	1,082 Spaces		$2,171,550	$673,181	$2,844,731	$542,888	$3,387,618
Passenger Facilities							
- Platform Decking (Uncovered)	11,000 S.F.	$10	$110,000	$34,100	$144,100	$27,500	$171,600
- Timber Shelters W/Decking (Savage, Rest Stops)	6,520 S.F.	$100	$652,000	$202,120	$854,120	$163,000	$1,017,120
Total Capital Costs			**$341,796,828**	**$86,894,192**	**$428,691,020**	**$53,677,832**	**$482,368,852**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	60 Empl	Varies	$1,134,494
Maintenance of Way	38 Empl	Budget x 2	$1,000,000
Fuel Consumption ($1.50/Gal.)			
- Train (.5 mpg)	248,018 Miles	$3.00	$744,055
- Std. Bus (6 mpg)	127,583 Miles	$0.25	$31,896
Parts & Preventative Maintenance			
- Train	248,018 Miles	$0.50	$124,009
- Bus	127,583 Miles	$0.25	$31,896
Overhead for Maintenance Facil	3 Facil	$25,000	$75,000
Total Oper. & Maint. Costs			**$3,141,350**

Annualized Cost Per Visitor

(7% Compound Interest)

	Total Cost	Life (Yrs)	Annualized
Facilities	$334,793,672	30	$26,979,618
Equipment			
- Cog Vehicles	$146,160,000	30	$11,778,509
- Buses Etc	$1,415,180	15	$155,379
Operation and Maintenance	$3,141,350	NA	$3,141,350
Total Annualized Cost			$42,055,056
Total Annual Visitors			444,000
Kantishna Visitors			0
Total Visitors			444,000
Annual Cost/Visitor			**$94.72**

Notes

- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

Denali Transit Alternative Cost Estimates
Alternative: 216 Passenger Cog Rail to Wonder Lake, Replace Rd., No Stampede Road

Capital Costs

Item	Units	Cost/Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Vehicles	26 Train	$5,250,000	$136,500,000	$21,840,000	$158,340,000	$0	$158,340,000
	4 Std. Bus	$151,500	$606,000	$96,960	$702,960	$0	$702,960
Radio System	1 System	$25,000	$25,000	$4,000	$29,000	$0	$29,000
Construction of Alignment	Estimate		$153,356,101	$47,540,391	$200,896,492	$38,339,025	$239,235,518
Maintenance Facility (Savage)	26 Train	$240,000	$6,240,000	$1,934,400	$8,174,400	$1,560,000	$9,734,400
Fuel Storage Tank(s) 2 (High)	47,000 Gallons	$2.50	$117,500	$36,425	$153,925	$29,375	$183,300
Utility Vehicles	Estimate		$100,000	$31,000	$131,000	$25,000	$156,000
Parking							
-Auto	890 Spaces	$1,500	$1,335,000		same		
-RV	331 Spaces	$3,225	$1,067,475		same		
Total	1,221 Spaces		$2,402,475	$744,767	$3,147,242	$600,619	$3,747,861
Passenger Facilities							
--Platform Decking (Uncovered)	12,250 S.F.	$10	$122,500	$37,975	$160,475	$30,625	$191,100
--Timber Shelters W/Decking (Savage, Rest Stops)	7,680 S.F.	$100	$768,000	$238,080	$1,006,080	$192,000	$1,198,080
Total Capital Costs			**$300,237,576**	**$72,503,999**	**$372,741,575**	**$40,776,644**	**$413,518,219**

Operation and Maintenance Costs

Staff (Drivers, Mechanics, Dispatchers, Laborers, Reservationists, Managers)	88 Empl	Varies	$1,268,265
Maintenance of Way	18 Empl	Budget	$500,000
Fuel Consumption ($1.50/Gal.)			
-Train (.5 mpg)	357,997 Miles	$3.00	$1,073,992
-Std. Bus (6 mpg)	96,348 Miles	$0.25	$24,087
Parts & Preventative Maintenance			
--Train	357,997 Miles	$0.50	$178,999
-Bus	96,348 Miles	$0.25	$24,087
Overhead for Maintenance Facil	2 Facil	$25,000	$50,000
Total Oper. & Maint. Costs			**$3,119,429**

Annualized Cost Per Visitor
(7% Compound Interest)

	Total Cost	Life (Yrs)	Annualized
Facilities	$254,290,259	30	$20,492,337
Equipment			
-Cog Vehicles	$158,340,000	30	$12,760,051
-Buses Etc.	$887,960	15	$97,493
Operation and Maintenance	$3,119,429	NA	$3,119,429
Total Annualized Cost			$36,469,311
Total Annual Visitors			444,000
Kantishna Visitors			11,433
Total Visitors			455,433
Annual Cost/Visitor			**$80.08**

Notes
- Equipment Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages were applied.
- Facility Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

DENALI COG RAILWAY COST ESTIMATE (OPTION –1A)

Replacing Existing Road from Savage to Eielson

ITEM #	PAY ITEM DESCRIPTION	PAY UNIT	UNIT COST	QUANTITY	EXTENSION
114(1)	CONSTRUCTION SURVEY BY THE CONTRACTOR	LUMP SUM	$2,100,000	1	$2,100,000
116(1)	FURNISHING AND MAINTAINING FIELD OFFICE	LUMP SUM	$20,000	1	$20,000
116(2)	FURNISHING AND MAINTAINING FIELD LABORATORY	LUMP SUM	$10,000	1	$10,000
116(3)	FURNISHING AND MAINTAINING CURING SHED	LUMP SUM	$5,000	1	$5,000
201(2B)	CLEARING AND GRUBBING	ACRE	$500	241	$120,500
203(3)	UNCLASSIFIED EXCAVATION	CUBIC YARD	$5	1,442,178	$7,210,890
204(1)	HAUL	C.Y.V.M.	$0.40	37,257,487	$14,902,994
	BALLAST	CUBIC YARD	$15	320,198	$4,802,970
	SUBBALLAST	CUBIC YARD	$6	433,839	$2,603,034
	TRACK & TIES	LINEAR FOOT	$75	604,032	$45,302,400
	TURNOUTS	EACH	$25,000	10	$250,000
630(2)	GEOTEXTILE, REINFORCEMENT	SQUARE YARD	$2.50	252,267	$630,668
603(1–36)	36 INCH CORRUGATED STEEL PIPE	LINEAR FOOT	$65	24,000	$1,560,000
603(3–36)	END SECTION FOR 36 INCH CORRUGATED STEEL PIPE	EACH	$300	684	$205,200
616(1)	3/4 INCH DIAMETER CULVERT THAW PIPE	LINEAR FOOT	$6	24,000	$144,000
618(2)	SEEDING	ACRE	$900	189	$170,100
620(2)	SALVAGED TOPSOIL	M.S.F.	$100	8,233	$823,284
640(1)	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	$3,600,000	1	$3,600,000
	BRIDGES	SQUARE FOOT	$200	55,473	$11,094,530
	MAJOR CULVERTS	EACH	$60,000	27	$1,637,251
	NET COST	SUBTOTAL			$97,192,821
	SUPERVISION AND CONTINGENCY	PERCENT	31%		$30,129,774
	GROSS COST	SUBTOTAL			$127,322,595
	PLANNING	PERCENT	25%		$24,298,205
	TOTAL	TOTAL			$151,620,800

DESCRIPTION	COST
DEMOLITION & REMOVAL	$4,587,142
GRADING AND DRAINAGE	$26,185,335
STABILIZATION	$54,695,814
MAJOR STRUCTURES	$11,724,530
SUPERVISION AND CONTINGENCY	$30,129,774
PLANNING	$24,298,205
TOTAL COST	$151,620,800

Note: – Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

DENALI COG RAILWAY COST ESTIMATE (OPTION –1B)

Replacing Existing Road from Eielson to Wonder Lake

ITEM #	PAY ITEM DESCRIPTION	PAY UNIT	UNIT COST	QUANTITY	EXTENSION
114(1)	CONSTRUCTION SURVEY BY THE CONTRACTOR	LUMP SUM	$700,000	1	$700,000
116(1)	FURNISHING AND MAINTAINING FIELD OFFICE	LUMP SUM	$10,000	1	$10,000
116(2)	FURNISHING AND MAINTAINING FIELD LABORATORY	LUMP SUM	$10,000	1	$10,000
116(3)	FURNISHING AND MAINTAINING CURING SHED	LUMP SUM	$5,000	1	$5,000
201(2B)	CLEARING AND GRUBBING	ACRE	$500	209	$104,500
203(3)	UNCLASSIFIED EXCAVATION	CUBIC YARD	$5	1,076,755	$5,383,775
204(1)	HAUL	C.Y.V.M.	$0.40	49,036,100	$19,614,440
	BALLAST	CUBIC YARD	$15	130,080	$1,951,200
	SUBBALLAST	CUBIC YARD	$6	176,247	$1,057,482
	TRACK & TIES	LINEAR FOOT	$75	230,736	$17,305,200
	TURNOUTS	EACH	$25,000	4	$100,000
630(2)	GEOTEXTILE, REINFORCEMENT	SQUARE YARD	$2.50	507,056	$1,267,640
603(1 - 36)	36 INCH CORRUGATED STEEL PIPE	LINEAR FOOT	$65	24,000	$1,560,000
603(3 - 36)	END SECTION FOR 36 INCH CORRUGATED STEEL PIPE	EACH	$300	684	$205,200
616(1)	3/4 INCH DIAMETER CULVERT THAW PIPE	LINEAR FOOT	$6	24,000	$144,000
618(2)	SEEDING	ACRE	$900	104	$93,600
620(2)	SALVAGED TOPSOIL	M.S.F.	$100	4,530	$453,024
640(1)	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	$1,200,000	1	$1,200,000
	BRIDGES	SQUARE FOOT	$200	21,777	$4,355,470
	MAJOR CULVERTS	EACH	$60,000	11	$642,749
	NET COST	SUBTOTAL			$56,163,280
	SUPERVISION AND CONTINGENCY	PERCENT	31%		$17,410,617
	GROSS COST	SUBTOTAL			$73,573,897
	PLANNING	PERCENT	25%		$14,040,820
	TOTAL	TOTAL			$87,614,716

DESCRIPTION	COST
DEMOLITION & REMOVAL	$27,725,164
GRADING AND DRAINAGE	$1,696,012
STABILIZATION	$22,176,634
MAJOR STRUCTURES	$4,565,470
SUPERVISION AND CONTINGENCY	$17,410,617
PLANNING	$14,040,820
TOTAL	$87,614,716

Note: – Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

South Slope Denali Transit Alternative Cost Estimate

Alternative: Aerial Tramway to Alder Point

Capital Costs

Item	Units	Cost Per Unit	Net Cost	Supervision & Contingency	Gross Cost	Planning	Total Cost
Tramway System Components and Construction, Two Sections (No Infrastructure Included)	Estimate		$52,500,000	$16,275,000	$68,775,000	$13,125,000	$81,900,000
Power Substation	1 Lump Sum	$1,500,000	$1,500,000	$465,000	$1,965,000	$375,000	$2,340,000
Power Distribution Line	15 Miles	$100,000	$1,500,000	$465,000	$1,965,000	$375,000	$2,340,000
Parking (Avg. of Low & High Daily Capacity Requirements)							
– Auto	142 Spaces	$1,500	$213,000				
– RV	58 Spaces	$3,225	$187,050				
Total	200 Spaces		$400,050	$124,016	$524,066	$100,013	$624,078
Total Capital Costs			**$55,900,050**	**$17,329,016**	**$73,229,066**	**$13,975,013**	**$87,204,078**

Operation and Maintenance Costs

Operation Staff	20 Empl.	Varies	$334,727
Maintenance Staff	9 Empl.	Varies	$191,913
Consumables (Full Service Year)	2 Sections	$70,000	$140,000
Total Oper. & Maint. Costs			**$666,640**

Annualized Cost Per Visitor

(7% Compound Interest)

	Total Cost	Life (Years)	Annualized
Facilities and Equipment	$87,204,078	30	$7,027,483
Operation and Maintenance	$666,640	NA	$666,640
Total Annualized Cost			$7,694,123
Total Annual Visitors			266,400
Annual Cost/Visitor			$28.88

Note – Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

Cost Estimation Methodologies

Alternative cost estimates were developed using selected available sources which represent comparable conditions and requirements to the given alternatives. Where possible, costs were developed based on facilities and services which currently exist in Denali National Park. The cost estimation methodologies for both bus, rail and tramway alternatives are summarized below.

Bus Alternatives

Vehicles

Bus fleet costs were developed to represent an average of a price range, due to the variety of vehicle types available. The low end for standard buses is based on the cost of the new Blue Bird bus currently used by ARA Leisure Services for the Denali Wilderness Tour. The high end unit cost for standard buses represents a price quote for the Transliner transit bus, made by the Neoplan Corporation.

Large bus fleet costs were derived from a range using an industry wide low end price for an articulated transit bus, to a high end price quote for the Skyliner double-decker coach bus made by the Neoplan Corporation.

Radio System

The radio system cost is based on a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991).

Construction of Stampede Road

BRW, Inc. construction estimate

Maintenance Facility

The maintenance facility cost is based on a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). The previous facility cost estimate was factored up based on the fleet size requirement for each alternative.

Fuel Storage Tanks

The necessary size of fuel storage tanks were estimated based on a one week fuel supply requirement, rounded up to the nearest thousand. A tank cost per gallon was developed using a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991).

Utility Vehicles

Utility vehicles were not defined as additions to the bus alternatives. The assumption is that some utility vehicles may already exist (ie: snowplows, service trucks) and tow trucks may be contracted as needed.

Parking Lots

Parking space requirements are based on planned daily visitor levels, auto occupancy assumptions and estimated visitor length of stay. Industry standards which assume moderate landscaping were used to apply square footage to space requirements. Parking space estimates also include existing proportions of auto and recreational vehicle use.

Costs per space are based on information found in "The Dimensions of Parking", Second Edition 1984, prepared by the Urban Land Institute (ULI) and National Parking Association (NPA). Costs may vary due to design preferences, exceptional conditions which must be dealt with, ancillary features and landscaping.

Passenger Facilities

Platform decking and timber shelters were sized for staging areas and rest stops based on minimal functional requirements. Costs were applied to these facilities based on information acquired from the National Park Service Architectural staff in Anchorage, Alaska.

Some additional facility requirements such as restrooms, picnic shelters and visitor information buildings were estimated for size but not cost.

Staff

Staff requirements were estimated for transportation related personnel only. Daily driver hours were calculated by using total trips and their respective cycle times under each alternative. The National Park Service VTS contracted service and the ARA Leisure Services transportation operation were used as guides to estimate daily labor hours for each other type of employee.

Daily hours were converted to weekly hours and total personnel were estimated based on a 40 hour work week with standard sick and personal time included. Employee pay rates were acquired from a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). Rates were factored up to represent a 4% pay increase for the current year. For the purposes of this study and the comparison among alternatives, employee wages were calculated over an approximate 16 week period (111 days) which represents the actual duration of the 1992 operating season. An actual system operation would vary due to differences in monthly activity levels and setup/shutdown requirements.

Maintenance of Way

Road maintenance costs were assumed to be consistent with the existing budget if no new roadway is constructed. Under alternatives which include the construction of Stampede Road, the maintenance costs and staff size are estimated to double.

Fuel Consumption

Daily miles traveled were calculated using total trips and their respective distances under each alternative. Fuel consumption for a standard bus was estimated to be the same as the existing ARA and VTS vehicles which operate on the Park Road today. Large bus fuel consumption is approximately twice the amount of the standard bus based on existing industry wide performance data. For the purposes of this study, annual fuel consumption was calculated over an approximate 16 week period (111 days) which represents the actual duration of the 1992 operating season. An actual system would vary due to differences in monthly activity levels and setup/shutdown requirements.

The cost of fuel per gallon used in the estimates is consistent with the costs currently charged in the National Park Service VTS contract. The cost per gallon was increased by $.05 to represent a potential annual increase. The existing contract also provides for a refund if actual fuel costs are less than the contracted amount.

Parts and Preventative Maintenance

Daily miles traveled were calculated using total trips and their respective distances under each alternative. Costs applied per mile for preventative parts and maintenance were based on a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991).

Overhead for Maintenance Facility

The overhead costs for upkeep and repair of the maintenance facility was based on a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). The cost was a lump sum and was not defined by specific provisions. This cost may vary dramatically and be dictated by facility size and random repair requirements.

Cog Rail Alternatives

Vehicles

Cog rail vehicle costs were based on the cost of vehicles purchased by the Manitou and Pike's Peak Railway Company for the Cog Railway system to Pike's Peak. The vehicles were purchased from the Swiss Locomotive and Machine Works Company in Switzerland. Costs were factored up to represent likely current values. Costs could vary due to the potential need or desire for customized vehicle types.

Radio System

The radio system cost is based on a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991).

Construction of Transit Alignment

BRW, Inc. cost estimate

Construction of Stampede Road

BRW, Inc. construction estimate

Maintenance Facility

The maintenance facility cost is based on a facility currently under construction in Denver, Colorado to accommodate the Regional Transportation District (RTD) Light Rail vehicle fleet. The actual fleet size is somewhat comparable to the cog rail alternative requirements. The size and cost for the model facility were factored proportionally based on the actual fleet size requirement for each alternative.

Fuel Storage Tanks

The necessary size of fuel storage tanks were estimated based on a one week fuel supply requirement, rounded up to the nearest thousand. It was assumed that there would likely be a fuel storage requirement at each end of the alignment. Fuel storage for the rail vehicles could also be combined with fuel storage requirements for the additional shuttle bus services. A tank cost per gallon was developed using a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991).

Utility Vehicles

An allowance was added for 2 to 3 utility vehicles which may be required for emergency train maintenance or special NPS trip requirements. Utility vehicle requirements would be defined more accurately during a conceptional engineering/alternative analysis exercise. A cargo vehicle was included into the fleet requirements for the rail alternatives and could also provide certain utility needs.

Parking Lots

Parking space requirements are based on planned daily visitor levels, auto occupancy assumptions and estimated visitor length of stay. Industry standards which assume moderate landscaping were used to apply square footage to space requirements. Parking space estimates also include existing proportions of auto and recreational vehicle use.

Costs per space are based on information found in "The Dimensions of Parking", Second Edition 1984, prepared by the Urban Land Institute (ULI) and National Parking Association (NPA). Costs may vary due to design preferences, exceptional conditions which must be dealt with, ancillary features and landscaping.

Passenger Facilities

Platform decking and timber shelters were sized for staging areas and rest stops based on minimal functional requirements. Costs were applied to these facilities based on information acquired from the National Park Service Architectural staff in Anchorage, Alaska.

Some additional facility requirements such as restrooms, picnic shelters and visitor information buildings were estimated for size but not cost.

Staff

Staff requirements were estimated for transportation related personnel only. Daily driver hours were calculated by using total trips and their respective cycle times under each alternative. The National Park

Service VTS contracted service and the ARA Leisure Services transportation operation were used as guides to estimate daily labor hours for each other type of employee.

Daily hours were converted to weekly hours and total personnel were estimated based on a 40 hour work week with standard sick and personal time included. Employee pay rates were acquired from a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). Rates were factored up to represent a 4% pay increase for the current year. For the purposes of this study and the comparison among alternatives, employee wages were calculated over an approximate 16 week period (111 days) which represents the actual duration of the 1992 operating season. An actual system operation would vary due to differences in monthly activity levels and setup/shutdown requirements.

Due to the unique technology of rail transit, some specialized labor requirements will be necessary.

Maintenance of Way

Rail maintenance costs were assumed to be consistent with the existing budget for roadway maintenance. Under alternatives which include the construction of Stampede Road, the maintenance costs and staff size are estimated to double.

Fuel Consumption

Daily miles traveled were calculated using total trips and their respective distances under each alternative. Fuel consumption for a cog rail vehicle was estimated to be .5 gallons of fuel per mile. This consumption rate is based on similar vehicles operating on varying types of terrain.

For shuttle bus services associated with the rail alternatives, fuel consumption for a standard bus was estimated to be the same as the existing ARA and VTS vehicles which operate on the Park Road today. For the purposes of this study, annual fuel consumption was calculated over an approximate 16 week period (111 days) which represents the actual duration of the 1992 operating season. An actual system would vary due to differences in monthly activity levels and setup/shutdown requirements.

The cost of fuel per gallon used in the estimates is consistent with the costs currently charged in the National Park Service VTS contract. The cost per gallon was increased by $.05 to represent a potential annual increase. The existing contract also provides for a refund if actual fuel costs are less than the contracted amount.

Parts and Preventative Maintenance

Daily miles traveled were calculated using total trips and their respective distances under each alternative. Costs applied per mile for preventative parts and maintenance of cog rail vehicles were assumed to be twice as much as the costs for buses. These costs were based on an initial estimate.

Overhead for Maintenance Facility

The overhead costs for upkeep and repair of the maintenance facility was based on a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). The cost was a lump sum and was not defined by specific provisions. This cost may vary dramatically and be dictated by facility size and random repair requirements.

The overhead cost was also applied to separate shuttle bus maintenance facility requirements associated with the rail alternatives.

South Slope Aerial Tramway Alternative

Tramway System Components and Construction

Due to the length of the tramway alternative being evaluated, no comparable construction costs are available for an existing system. A cost estimate for the tramway alternative was obtained from CTEC, Inc., Salt Lake City, Utah. CTEC is a representative for Garaventa (tramway manufacturer). The cost estimate is based on requirements for a two section system of approximate equal lengths. The sections would be linked by a midway transfer terminal. The requirements for two sections is dictated by drive power capabilities and cable tension technology. Verification of section requirements could be made through a more detailed examination of the study area terrain.

Power Substation and Distribution Line

Tramway power requirements were estimated based on a range of consumption levels found for existing systems. A more detailed system design would be required to estimate actual power consumption requirements.

Power source costs were obtained from a representative for the Golden Valley Power Company in Anchorage, Alaska. The costs are based on approximate system consumption levels and the estimated length of access to the Anchorage/Fairbanks transmission tie line. There is currently no electricity provided to any facilities in the south slope study area.

Parking Lots

Parking space requirements are based on the average of a range of daily visitor capacity levels, auto occupancy levels and estimated visitor length of stay. Industry standards which assume moderate landscaping were used to apply square footage to space requirements. Parking space estimates also include existing proportions of auto and recreational vehicle use.

Costs per space are based on information found in "The Dimensions of Parking", Second Edition 1984, prepared by the Urban Land Institute (ULI) and National Parking Association (NPA). Costs may vary due to design preferences, exceptional conditions which must be dealt with, ancillary features and landscaping.

Operation Staff

The number of system operators was calculated based on requirements of existing tramway systems. It is assumed that one skilled operator would be present at each terminal and in each tram cabin. Daily labor hours were calculated for a twelve hour operating duration.

Daily hours were converted to weekly hours and total personnel were estimated based on a 40 hour work week with standard sick and personal time included. Employee pay rates were acquired from a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). Hourly rates for tramway operators were estimated to be comparable with bus and rail transit vehicle operator rates. The rates were factored up to represent a 4% pay increase for the current year. For the purposes of this study and the comparison among alternatives, employee wages were calculated over an approximate 16 week period (111 days) which represents the actual duration of the 1992 operating season. An actual system operation would vary due to differences in monthly activity levels and setup/shutdown requirements.

Maintenance Staff

The number of system maintenance personnel was calculated based on requirements of existing tramway systems. It is assumed that two persons per tramway section would be on duty at all times.

Daily hours were converted to weekly hours and total personnel were estimated based on a 40 hour work week with standard sick and personal time included. Employee pay rates were acquired from a previous estimate prepared by Denali Park staff regarding proposed options for operation of the VTS system (1991). Hourly rates for tramway maintenance personnel were estimated to be comparable with bus and rail transit heavy equipment mechanic rates. The rates were factored up to represent a 4% pay increase for the current year. For the purposes of this study and the comparison among alternatives, employee wages were calculated over an approximate 16 week period (111 days) which represents the actual duration of the 1992 operating season. An actual system operation would vary due to differences in monthly activity levels and setup/shutdown requirements.

Consumables

The costs for parts, routine maintenance materials and operating consumables will vary somewhat from a standard year to an overhaul year. Typically a system overhaul will be required every third or fourth year and involves the replacement of a larger quantity of parts. The cost estimate for consumables developed for this study represents a likely first full service year for a new system. These costs may also be a factor of the actual length of the operating season and daily hours of operation.

Appendix 3: Denali Transit Alternatives Trip Type and Cycle Time Worksheets

Denali VTS Capacity Requirements
Standard Bus, No Stampede Road

Variable	Input or Result	Comments
Transit System Visitors	2,521	Maximum Capacity With Daily Allotment (58 Trips)
Hotel Lodging (Units)	150	Future Capacity
Hotel Party Size	2.0	Most Common Calc. From Visitor Study
Hotel Visitors	300	
Hotel Turnover Rate	53%	Avg. Calc. From Visitor Study
Hotel Visitor Transit Demand	**159**	
Remaining Hotel Visitors	141	
Camping Before Savage (Sites)	142	Existing Riley Crk. and Savage River
Camping Party Size	3.0	Estimated
Camping Visitors Before Savage	426	
Morino Campground (People)	60	Existing
Total Camping Before Savage	486	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Before Sav)	**258**	
Remaining Camping Visitors	228	
Camping Past Savage (Sites)	92	Existing
Camping Party Size	3.0	Estimated
Camping Visitors Past Savage	276	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Past Sav)	**146**	
Backcountry Past Savage (People)	154	Existing (Not Incl. Unlimited Units)
Backcountry Turnover Rate	65%	Avg. Calc. From 1992 Statistics
Fixed Backcountry Units Transit Demand	100	
Unlimited Backcountry Units Transit Demand	21	Avg. Daily People Issued Permit In 1992 Pk. Month
Back Visitor Transit Demand (Past Sav)	**121**	
Overnight Visitor Transit Demand	**267**	
Day Use Arrival Transit Demand	**1,837**	2,521 Less Hotel, Campers & Overnight Visitors
Hotel & Camping Visitor Transit Demand	**417**	Hotel & Campers Before Savage
Total Day Use Transit Demand	**2,254**	
Overnight Visitor Transit Demand	**267**	Campers & Backcountry Past Savage

Analysis of Alternative Transit Modes
Savage River to Stony Hill (0%), Eielson (75%) and Wonder Lake (25%)
Using 52 Passenger Buses

	Eiel	WL	ONght WL
One-Way Distance (mi)	53.2	73.3	73.3
Average Veh Speed (mph) Incl. Rest Stops	18	18	18
One-Way Time (min)	177.3	244.3	244.3
Arrival Duration (hrs)	9	6	6
Minimum Cycle Time	425.6	586.4	586.4
Calculated Headway (min)	14.59	30.00	40.00
Actual Min Headway (min)	**12**	**30**	**40**
Min Cycle/Headway	35.5	19.5	14.7
Actual Cycle Time (min)	**432.0**	**600.0**	**600.0**
Actual Cycle Time (hrs)	**7.2**	**10.0**	**10.0**

Day Use Passengers =	2,254
Overnight Pass (Past Savage) =	267

Share of Trips	75.5%	24.5%	100%	
	Day Eiel	**Day WL**	**ONght**	**Total**
Daily Volume (pass)	**1,702**	**552**	**267**	**2,522**
Vehicle Capacity (Red. by 10%, Intra-Park Trips)	46	46	32	
Veh Trips/Day Needed	**37.0**	**12.0**	**9.0**	**58**
Max Vehicles Required	**36**	**12**	**9**	**57**
Revised Vehicles Required With Recycling	**32**	**12**	**9**	**53**
In-Vehicle Time (hrs)	5.9	8.1	8.1	
Total Out-of-Vehicle Time (hrs)	2.0	2.0	----	
Total Visit Time or Time Parked (hrs)	**7.9**	**10.1**	----	

Front Country Shuttle Requirements

Daily Shuttle Passenger Requirements From Front Country to Savage Staging Area	417	Hotel & Camping Visitor Transit Demand (Includes Savage River Campers)
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	9	
Distance from Riley Crk. to Savage Staging (mi)	12.4	
Average Bus Speed (mph)	30	
One-Way Time (min)	24.8	
Intermediate Stop Times (1 min. * 5)	5.0	Riley, Morino, Hotel, VAC, Train Depot
Minimum Cycle Time	69.5	
Buses/Hour Desirable	**2**	
Min Cycle/Headway	2.3	
Actual Cycle Time	**90**	
Buses Required	**3**	
Wait Time (min)	15	

Daily Shuttle Passenger Requirements From Lodging Outside Park to Savage	919	One Half Day Use Arrival Transit Demand
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	**18**	

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Denali VTS Capacity Requirements
Standard Bus, With Stampede Road

Variable	Input or Result	Comments
Transit System Visitors	3,073	Maximum Capacity With Daily Allotment (58 Trips)
Hotel Lodging (Units)	150	Future Capacity
Hotel Party Size	2.0	Most Common Calc. From Visitor Study
Hotel Visitors	300	
Hotel Turnover Rate	53%	Avg. Calc. From Visitor Study
Hotel Visitor Transit Demand	**159**	
Remaining Hotel Visitors	141	
Camping Before Savage (Sites)	142	Existing Riley Crk. and Savage River
Camping Party Size	3.0	Estimated
Camping Visitors Before Savage	426	
Morino Campground (People)	60	Existing
Total Camping Before Savage	486	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Before Sav)	**258**	
Remaining Camping Visitors	228	
Camping Past Savage (Sites)	92	Existing
Camping Party Size	3.0	Estimated
Camping Visitors Past Savage	276	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Past Sav)	**146**	
Backcountry Past Savage (People)	154	Existing (Not Incl. Unlimited Units)
Backcountry Turnover Rate	65%	Avg. Calc. From 1992 Statistics
Fixed Backcountry Units Transit Demand	100	
Unlimited Backcountry Units Transit Demand	21	Avg. Daily People Issued Permit In 1992 Pk. Month
Back Visitor Transit Demand (Past Sav)	**121**	
Overnight Visitor Transit Demand	**267**	
Day Use Arrival Transit Demand	**2,389**	3,073 Less Hotel, Campers & Overnight Visitors
Hotel & Camping Visitor Transit Demand	**417**	Hotel & Campers Before Savage
Total Day Use Transit Demand	**2,806**	
Overnight Visitor Transit Demand	**267**	Campers & Backcountry Past Savage

Analysis of Alternative Transit Modes
Savage River to Stony Hill (0%), Eielson (61%) and Wonder Lake (39%)
Using 52 Passenger Buses, With Stampede Road

	Eiel	WL	ONght WL
One-Way Distance (mi)	53.2	73.3	73.3
Average Veh Speed (mph) Incl. Rest Stops	18	18	18
One-Way Time (min)	177.3	244.3	244.3
Arrival Duration (hrs)	9	6	6
Minimum Cycle Time	425.6	586.4	586.4
Calculated Headway (min)	14.59	15.00	40.00
Actual Min Headway (min)	**12**	**15**	**40**
Min Cycle/Headway	35.5	39.1	14.7
Actual Cycle Time (min)	**432.0**	**600.0**	**600.0**
Actual Cycle Time (hrs)	**7.2**	**10.0**	**10.0**

Day Use Passengers =	**2,806**
Overnight Pass (Past Savage) =	**267**

Share of Trips	60.7%	39.3%	100%	
	Day Eiel	**Day WL**	**ONght**	**Total**
Daily Volume (pass)	**1,702**	**1,104**	**267**	**3,073**
Vehicle Capacity (Red. by 10%, Intra-Park Trips)	46	46	32	
Veh Trips/Day Needed	**37.0**	**24.0**	**9.0**	**70**
Max Vehicles Required	**36**	**24**	**9**	**69**
Revised Vehicles Required With Recycling	**32**	**24**	**9**	**65**
In-Vehicle Time (hrs)	5.9	8.1	8.1	
Total Out-of-Vehicle Time (hrs)	2.0	2.0	---	
Total Visit Time or Time Parked (hrs)	**7.9**	**10.1**	---	

Front Country Shuttle Requirements

Daily Shuttle Passenger Requirements From Front Country to Savage Staging Area	417	Hotel & Camping Visitor Transit Demand (includes Savage River Campers)
Bus Capacity	52	
Minimum One–Way Trip Demand/Day	9	
Distance from Riley Crk. to Savage Staging (mi)	12.4	
Average Bus Speed (mph)	30	
One–Way Time (min)	24.8	
Intermediate Stop Times (1 min. * 5)	5.0	Riley, Morino, Hotel, VAC, Train Depot
Minimum Cycle Time	69.5	
Buses/Hour Desirable	**2**	
Min Cycle/Headway	2.3	
Actual Cycle Time	**90**	
Buses Required	**3**	
Wait Time (min)	15	

Daily Shuttle Passenger Requirements From Lodging Outside Park to Savage	1,195	One Half Day Use Arrival Transit Demand
Bus Capacity	52	
Minimum One–Way Trip Demand/Day	**23**	

Denali VTS Capacity Requirements
Large Bus, No Stampede Road

Variable	Input or Result	Comments
Transit System Visitors	3,595	Maximum Capacity With Daily Allotment (58 Trips)
Hotel Lodging (Units)	150	Future Capacity
Hotel Party Size	2.0	Most Common Calc. From Visitor Study
Hotel Visitors	300	
Hotel Turnover Rate	53%	Avg. Calc. From Visitor Study
Hotel Visitor Transit Demand	**159**	
Remaining Hotel Visitors	141	
Camping Before Savage (Sites)	142	Existing Riley Crk. and Savage River
Camping Party Size	3.0	Estimated
Camping Visitors Before Savage	426	
Morino Campground (People)	60	Existing
Total Camping Before Savage	486	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Before Sav)	**258**	
Remaining Camping Visitors	228	
Camping Past Savage (Sites)	92	Existing
Camping Party Size	3.0	Estimated
Camping Visitors Past Savage	276	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Past Sav)	**146**	
Backcountry Past Savage (People)	154	Existing (Not Incl. Unlimited Units)
Backcountry Turnover Rate	65%	Avg. Calc. From 1992 Statistics
Fixed Backcountry Units Transit Demand	100	
Unlimited Backcountry Units Transit Demand	21	Avg. Daily People Isued Permit In 1992 Pk. Month
Back Visitor Transit Demand (Past Sav)	**121**	
Overnight Visitor Transit Demand	**267**	
Day Use Arrival Transit Demand	**2,911**	3,595 Less Hotel, Campers & Overnight Visitors
Hotel & Camping Visitor Transit Demand	**417**	Hotel & Campers Before Savage
Total Day Use Transit Demand	**3,328**	
Overnight Visitor Transit Demand	**267**	Campers & Backcountry Past Savage

Analysis of Alternative Transit Modes
Savage River to Stony Hill (0%), Eielson (75%) and Wonder Lake (25%)
Using 72 Passenger Articulated or Double Decker Buses

	Eiel	WL	ONght WL
One-Way Distance (mi)	53.2	73.3	73.3
Average Veh Speed (mph) Incl. Rest Stops	18	18	18
One-Way Time (min)	177.3	244.3	244.3
Arrival Duration (hrs)	9	6	6
Minimum Cycle Time	425.6	586.4	586.4
Calculated Headway (min)	13.85	27.69	60.00
Actual Min Headway (min)	**12**	**20**	**60**
Min Cycle/Headway	35.5	29.3	9.8
Actual Cycle Time (min)	**432.0**	**600.0**	**600.0**
Actual Cycle Time (hrs)	**7.2**	**10.0**	**10.0**

Day Use Passengers =	**3,328**
Overnight Pass (Past Savage) =	**267**

Share of Trips	75.0%	25.0%	100%	
	Day Eiel	Day WL	ONght	Total
Daily Volume (pass)	**2,496**	**832**	**267**	**3,595**
Vehicle Capacity (Red. by 10%, Intra-Park Trips)	64	64	48	
Veh Trips/Day Needed	**39.0**	**13.0**	**6.0**	**58**
Max Vehicles Required	**36**	**13**	**6**	**55**
Revised Vehicles Required With Recycling	**34**	**13**	**6**	**53**
In-Vehicle Time (hrs)	5.9	8.1	8.1	
Total Out-of-Vehicle Time (hrs)	2.0	2.0	---	
Total Visit Time or Time Parked (hrs)	**7.9**	**10.1**	---	

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Front Country Shuttle Requirements

Daily Shuttle Passenger Requirements From Front Country to Savage Staging Area	417	Hotel & Camping Visitor Transit Demand (Includes Savage River Campers)
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	9	
Distance from Riley Crk. to Savage Staging (mi)	12.4	
Average Bus Speed (mph)	30	
One-Way Time (min)	24.8	
Intermediate Stop Times (1 min. * 5)	5.0	Riley, Morino, Hotel, VAC, Train Depot
Minimum Cycle Time	69.5	
Buses/Hour Desirable	2	
Min Cycle/Headway	2.3	
Actual Cycle Time	90	
Buses Required	3	
Wait Time (min)	15	

Daily Shuttle Passenger Requirements From Lodging Outside Park to Savage	1,456	One Half Day Use Arrival Transit Demand
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	28	

Denali VTS Capacity Requirements
Large Bus, With Stampede Road

Variable	Input or Result	Comments
Transit System Visitors	4,000	Planning Level Goal
Hotel Lodging (Units)	150	Future Capacity
Hotel Party Size	2.0	Most Common Calc. From Visitor Study
Hotel Visitors	300	
Hotel Turnover Rate	53%	Avg. Calc. From Visitor Study
Hotel Visitor Transit Demand	**159**	
Remaining Hotel Visitors	141	
Camping Before Savage (Sites)	142	Existing Riley Crk. and Savage River
Camping Party Size	3.0	Estimated
Camping Visitors Before Savage	426	
Morino Campground (People)	60	Existing
Total Camping Before Savage	486	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Before Sav)	**258**	
Remaining Camping Visitors	228	
Camping Past Savage (Sites)	92	Existing
Camping Party Size	3.0	Estimated
Camping Visitors Past Savage	276	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Past Sav)	**146**	
Backcountry Past Savage (People)	154	Existing (Not Incl. Unlimited Units)
Backcountry Turnover Rate	65%	Avg. Calc. From 1992 Statistics
Fixed Backcountry Units Transit Demand	100	
Unlimited Backcountry Units Transit Demand	21	Avg. Daily People Isued Permit in 1992 Pk. Month
Back Visitor Transit Demand (Past Sav)	**121**	
Overnight Visitor Transit Demand	**267**	
Day Use Arrival Transit Demand	**3,316**	4,000 Less Hotel, Campers & Overnight Visitors
Hotel & Camping Visitor Transit Demand	**417**	Hotel & Campers Before Savage
Total Day Use Transit Demand	**3,733**	
Overnight Visitor Transit Demand	**267**	Campers & Backcountry Past Savage

Analysis of Alternative Transit Modes
Savage River to Stony Hill (0%), Eielson (66%) and Wonder Lake (34%)
Using 72 Passenger Articulated or Double Decker Buses, With Stampede Road

	Eiel	WL	ONght WL
One-Way Distance (mi)	53.2	73.3	73.3
Average Veh Speed (mph) Incl. Rest Stops	18	18	18
One-Way Time (min)	177.3	244.3	244.3
Arrival Duration (hrs)	9	6	6
Minimum Cycle Time	425.6	586.4	586.4
Calculated Headway (min)	13.85	18.00	60.00
Actual Min Headway (min)	**12**	**15**	**60**
Min Cycle/Headway	35.5	39.1	9.8
Actual Cycle Time (min)	**432.0**	**600.0**	**600.0**
Actual Cycle Time (hrs)	**7.2**	**10.0**	**10.0**

Day Use Passengers =	3,733
Overnight Pass (Past Savage) =	267

Share of Trips	66.0%	34.0%	100%	
	Day Eiel	**Day WL**	**ONght**	**Total**
Daily Volume (pass)	**2,464**	**1,269**	**267**	**4,000**
Vehicle Capacity (Red. by 10% Intra-Park Trips)	64	64	48	
Veh Trips/Day Needed	**39.0**	**20.0**	**6.0**	**65**
Max Vehicles Required	**36**	**20**	**6**	**62**
Revised Vehicles Required With Recycling	**34**	**20**	**6**	**60**
In-Vehicle Time (hrs)	5.9	8.1	8.1	
Total Out-of-Vehicle Time (hrs)	2.0	2.0	---	
Total Visit Time or Time Parked (hrs)	**7.9**	**10.1**	---	

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Front Country Shuttle Requirements

Daily Shuttle Passenger Requirements From Front Country to Savage Staging Area	417	Hotel & Camping Visitor Transit Demand (Includes Savage River Campers)
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	9	
Distance from Riley Crk. to Savage Staging (mi)	12.4	
Average Bus Speed (mph)	30	
One-Way Time (min)	24.8	
Intermediate Stop Times (1 min * 5)	5.0	Riley, Morino, Hotel, VAC, Train Depot
Minimum Cycle Time	69.5	
Buses/Hour Desirable	2	
Min Cycle/Headway	2.3	
Actual Cycle Time	90	
Buses Required	3	
Wait Time (min)	15	

Daily Shuttle Passenger Requirements From Lodging Outside Park to Savage	1,658	One Half Day Use Arrival Transit Demand
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	32	

Denali VTS Capacity Requirements

Cog Rail to Eielson, No Stampede Road

Variable	Input or Result	Comments
Transit System Visitors	4,000	Planning Level Goal (Not Incl. Kant., Misc., NPS)
Hotel Lodging (Units)	150	Future Capacity
Hotel Party Size	2.0	Most Common Calc. From Visitor Study
Hotel Visitors	300	
Hotel Turnover Rate	53%	Avg. Calc. From Visitor Study
Hotel Visitor Transit Demand	**159**	
Remaining Hotel Visitors	141	
Camping Before Savage (Sites)	142	Existing Riley Crk. and Savage River
Camping Party Size	3.0	Estimated
Camping Visitors Before Savage	426	
Morino Campground (People)	60	Existing
Total Camping Before Savage	486	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Before Sav)	**258**	
Remaining Camping Visitors	228	
Camping Past Savage (Sites)	92	Existing
Camping Party Size	3.0	Estimated
Camping Visitors Past Savage	276	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Past Sav)	**146**	
Backcountry Past Savage (People)	154	Existing (Not Incl. Unlimited Units)
Backcountry Turnover Rate	65%	Avg. Calc. From 1992 Statistics
Fixed Backcountry Units Transit Demand	100	
Unlimited Backcountry Units Transit Demand	21	Avg. Daily People Issued Permit in 1992 Pk. Month
Back Visitor Transit Demand (Past Sav)	**121**	
Overnight Visitor Transit Demand	**267**	
Day Use Arrival Transit Demand	**3,316**	4,000 Less Hotel, Campers & Overnight Visitors
Hotel & Camping Visitor Transit Demand	**417**	Hotel & Campers Before Savage
Total Day Use Transit Demand	**3,733**	
Overnight Visitor Transit Demand	**267**	Campers & Backcountry Past Savage

Analysis of Alternative Transit Modes
Savage River to Stony Hill (0%), Eielson (100%) and Wonder Lake (0%)
Using 216 Passenger Cog Rail Vehicle

	Eiel
One-Way Distance (mi)	53.2
Average Veh Speed (mph) Incl. Rest Stops	18
One-Way Time (min)	177.3
Arrival Duration (hrs)	9
Minimum Cycle Time	425.6
Calculated Headway (min)	25.71
Actual Min Headway (min)	**20**
Min Cycle/Headway	21.3
Actual Cycle Time (min)	**440.0**
Actual Cycle Time (hrs)	**7.3**

Day Use Passengers = 3,733
Overnight Pass (Past Savage) = 267

Share of Trips	100%	
	Day Eiel	Total
Daily Volume (pass)	**4,000**	**4,000**
Vehicle Capacity (Red. by 10% Intra-Park Trips	194	
Veh Trips/Day Needed	**21.0**	**21**
Max Vehicles Required	**21**	**21**
Revised Vehicles Required With Recycling	**20**	**20**
In-Vehicle Time (hrs)	5.9	
Total Out-of-Vehicle Time (hrs)	2.0	
Total Visit Time or Time Parked (hrs)	**7.9**	

Front Country Shuttle Requirements

Daily Shuttle Passenger Requirements From Front Country to Savage Staging Area	417	Hotel & Camping Visitor Transit Demand (Includes Savage River Campers)
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	9	
Distance from Riley Crk. to Savage Staging (mi)	12.4	
Average Bus Speed (mph)	30	
One-Way Time (min)	24.8	
Intermediate Stop Times (1 min. * 5)	5.0	Riley, Morino, Hotel, VAC, Train Depot
Minimum Cycle Time	69.5	
Buses/Hour Desirable	2	
Min Cycle/Headway	2.3	
Actual Cycle Time	90	
Buses Required	3	
Wait Time (min)	15	

Daily Shuttle Passenger Requirements From Lodging Outside Park to Savage	1,658	One Half Day Use Arrival Transit Demand
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	32	

Denali VTS Capacity Requirements
Cog Rail to Wonder Lake, No Stampede Road

Variable	Input or Result	Comments
Transit System Visitors	4,000	Planning Level Goal (Not Incl. Kant., Misc., NPS)
Hotel Lodging (Units)	150	Future Capacity
Hotel Party Size	2.0	Most Common Calc. From Visitor Study
Hotel Visitors	300	
Hotel Turnover Rate	53%	Avg. Calc. From Visitor Study
Hotel Visitor Transit Demand	159	
Remaining Hotel Visitors	141	
Camping Before Savage (Sites)	142	Existing Riley Crk. and Savage River
Camping Party Size	3.0	Estimated
Camping Visitors Before Savage	426	
Morino Campground (People)	60	Existing
Total Camping Before Savage	486	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
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Camping Party Size	3.0	Estimated
Camping Visitors Past Savage	276	
Camping Turnover Rate	53%	Avg. Calc. From Visitor Study
Camp Visitor Transit Demand (Past Sav)	146	
Backcountry Past Savage (People)	154	Existing (Not Incl. Unlimited Units)
Backcountry Turnover Rate	65%	Avg. Calc. From 1992 Statistics
Fixed Backcountry Units Transit Demand	100	
Unlimited Backcountry Units Transit Demand	21	Avg. Daily People Issued Permit In 1992 Pk. Month
Back Visitor Transit Demand (Past Sav)	121	
Overnight Visitor Transit Demand	267	
Day Use Arrival Transit Demand	3,316	4,000 Less Hotel, Campers & Overnight Visitors
Hotel & Camping Visitor Transit Demand	417	Hotel & Campers Before Savage
Total Day Use Transit Demand	3,733	
Overnight Visitor Transit Demand	267	Campers & Backcountry Past Savage

Analysis of Alternative Transit Modes
Savage River to Stony Hill (0%), Eielson (0%) and Wonder Lake (100%)
Using 216 Passenger Cog Rail Vehicle

	WL
One - Way Distance (mi)	73.3
Average Veh Speed (mph) Incl. Rest Stops	18
One - Way Time (min)	244.3
Arrival Duration (hrs)	6
Minimum Cycle Time	586.4
Calculated Headway (min)	17.14
Actual Min Headway (min)	15
Min Cycle/Headway	39.1
Actual Cycle Time (min)	600.0
Actual Cycle Time (hrs)	10.0

Day Use Passengers = 3,733
Overnight Pass (Past Savage) = 267

Share of Trips	100%	
	Day WL	Total
Daily Volume (pass)	4,000	4,000
Vehicle Capacity (Red. by 10% Intra-Park Trips)	194	
Veh Trips/Day Needed	21.0	21
Max Vehicles Required	21	21
In - Vehicle Time (hrs)	8.1	
Total Out - of - Vehicle Time (hrs)	2.0	
Total Visit Time or Time Parked (hrs)	10.1	

Front Country Shuttle Requirements

Daily Shuttle Passenger Requirements From Front Country to Savage Staging Area	417	Hotel & Camping Visitor Transit Demand (Includes Savage River Campers)
Bus Capacity	52	
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Intermediate Stop Times (1 min. * 5)	5.0	Riley, Morino, Hotel, VAC, Train Depot
Minimum Cycle Time	69.6	
Buses/Hour Desirable	2	
Min Cycle/Headway	2.3	
Actual Cycle Time	90	
Buses Required	3	
Wait Time (min)	15	

Daily Shuttle Passenger Requirements From Lodging Outside Park to Savage	1,658	One Half Day Use Arrival Transit Demand
Bus Capacity	52	
Minimum One-Way Trip Demand/Day	32	

Appendix 4: Resource Impact Details from Alternative Evaluation

Alternative - Standard Bus, Without Stampede Road

Wilderness encroachment

- Potential encroachment if staging area is located at Savage River.

Resource impacts

- Increased personal auto traffic on the existing road from MP 3 - 13 to Savage River staging area would extend difficult-to-manage pedestrian activity further into the park
- wildlife and habitat disturbance would occur adjacent to new facilities from increased social trail formation, human activity, and noise.

Construction impacts

- New facilities at the Savage staging area, and improvements at rest stops and at Eielson would increase local soil erosion, sedimentation and habitat disturbance.
- Impacts in and outside the Park from material excavation and importation activities.

Compliance

- At a minimum, an environmental assessment would be required for gravel excavation and the staging area at Savage.

Alternative - Standard Bus, With Stampede Road

Wilderness encroachment

- Potential if staging area is located at Savage River.

Resource impacts

- Wildlife and habitat disturbance would occur adjacent to new facilities from increased social trail formation, human activity, and noise.
- Increased personal auto traffic on the existing road from MP 3 - 13 to Savage River staging area would extend difficult-to-manage pedestrian activity further into the park.
- Opening the Stampede corridor would sever pristine habitat and segment the park with an additional transit corridor, bounding the Wyoming Hills range on the north and south with human development.
- The Stampede corridor would potentially affect caribou wintering and calving habitat, raptor habitat, and primary moose habitat, and introduce potential disturbance to new, non-habituated wildlife populations. New access would also increase the potential for wildlife poaching.
- Impacts on natural vegetation from the Stampede corridor would include: influences of imported material containing non-native biota; disturbance to wet tundra; and riparian habitat; and effects to hydrology, water quality, and aquatic habitat of five major river corridors (including the clear-running Savage River, Clearwater and Moose Creek systems).
- Probable archaeological resource disturbance and influences to historic structures in Kantishna would occur with the Stampede corridor alternative.

Construction impacts

- New facilities at the Savage staging area, and improvements at rest stops and at Eielson would increase local soil erosion, sedimentation, and habitat disturbance.
- Water quality impacts, noise, equipment emissions, and dust would occur from construction staging activity along Stampede corridor.
- There would be at least two seasons of wildlife disturbance and displacement during Stampede corridor construction.
- Resource impacts from construction crew staging would occur.
- Impacts in and outside the park from gravel extraction and importation activities.

Compliance

- At a minimum, an environmental assessment would be required for gravel excavation and the staging area at Savage, an environmental impact statement would be anticipated for the Stampede corridor. The scope of the Stampede corridor portion of the environmental impact statement would be significant.

Alternative - Large Bus, Without Stampede Road

The impacts are the same as for the standard bus without Stampede Road except that the use of a larger bus may require increased road maintenance activities and gravel needs with the potential to the affect adjacent habitat and wildlife activity.

Alternative - Large Bus, With Stampede Road

The impacts are the same as for the standard bus with Stampede Road except that the use of a larger bus may require increased road maintenance activities and gravel needs with the potential to the affect adjacent habitat and wildlife activity.

Alternative - Cog Rail to Eielson, Without Stampede Road

Wilderness encroachment

- Potential encroachment if staging area is located at Savage River.
- Possible minor incursions in geometrically confined areas.
- Potential encroachment by Wonder Lake shuttle maintenance facility required in Eielson to Wonder Lake segment.

Resource Impacts

- Increased personal auto traffic on the existing road from MP 3 - 13 to Savage River staging area would extend difficult-to-manage pedestrian activity further into the park.
- Post-construction healing of existing road edge habitat by the elimination of dust, and continuous grading would be a long-term resource improvement.
- Significantly fewer vehicle events would decrease wildlife migration disturbance along the corridor.
- Elimination of dust would improve viewing conditions and local air quality.

- Wildlife and habitat disturbance would occur adjacent to new facilities from increased social trail formation and higher concentrations of visitors and human activity.
- The potential would exist for fuel spills in the Park interior at Savage and Eielson storage sites.
- Long term improvement in natural wildlife movement patterns.

Construction impacts

- New facilities at the Savage staging area, and improvements at rest stops and at Eielson would increase local soil erosion, sedimentation, and habitat disturbance.
- Impacts in and outside the park from gravel excavation and importation activities.
- Water quality impacts, noise, equipment emissions, and dust would occur from construction staging activity would occur.
- At least two seasons of wildlife disturbance and displacement during construction would occur.
- There would be no public access beyond the Savage staging area during construction.

Compliance

- An environmental impact statement will be required for park closure, extensive gravel excavation, expanding facilities and cog storage/maintenance, and fuel storage facilities at Eielson and Savage.

Alternative - Cog Rail to Eielson, With Stampede Road

Wilderness encroachment

- Same as Cog Rail to Eielson alternative without Stampede Road.

Resource impacts

- Same as Cog Rail to Eielson alternative without Stampede Road including the following:
- Wildlife and habitat disturbance would occur adjacent to new facilities from increased social trail formation and higher concentrations of visitors and human activity
- The Stampede corridor would potentially affect caribou wintering and calving habitat, raptor habitat, and primary moose habitat, and introduce potential disturbance to new, non-habituated wildlife populations. New access will increase the potential for wildlife poaching.
- Impacts on natural vegetation from the Stampede corridor would include: influences of imported material containing non-native biota; disturbance to wet tundra; and riparian habitat; and effects to hydrology, water quality, and aquatic habitat of five major river corridors (including the clear-running Savage River, Clearwater and Moose Creek systems)
- Probable archaeological resource disturbance and influences to historic structures in Kantishna would occur with the Stampede corridor alternative.
- Opening the Stampede corridor would sever pristine habitat and segment the park with an additional transit corridor, bounding the Wyoming Hills range on the north and south with human development.

Construction impacts

- Same as Cog Rail to Eielson alternative without Stampede Road including the following:
- Resource impacts from construction crew staging would occur.
- Minor realignment for the Cog will introduce adjacent habitat impacts.

Compliance

- An environmental impact statement will be required for park closure, extensive gravel excavation, and cog storage/maintenance, and fuel storage facilities at Eielson and Savage. The Stampede corridor would expand the scope of the environmental impact statement significantly.

Alternative - Cog Rail to Wonder Lake, Without Stampede Road

Wilderness encroachment

- Same as Cog Rail to Eielson alternative without Stampede Road except potential encroachment by Kantisna shuttle maintenance facility required in Wonder Lake to Kantishna segment.

Resource impacts

- Same as Cog Rail to Eielson alternative without Stampede Road except Cog storage/maintenance and fuel storage would be located at Wonder Lake and Savage with the potential for fuel spills at those sites.

Construction impacts

- Same as Cog Rail to Eielson alternative without Stampede Road except that significant amounts of additional material would be required for rail grade improvements between Eielson and Wonder Lake and site and habitat disturbance would occur at the Wonder Lake rest stop.

Compliance

- An environmental impact statement will be required for park closure, extensive gravel excavation, and cog storage/maintenance, and fuel storage facilities at Eielson, Wonder Lake, and Savage.

South Slope Tramway to Alder Point

Wilderness encroachment

- This alternative would open an entirely new corridor into the wilderness

Resource Impacts

- Activity at the tram staging areas would induce social trail development and localized wildlife disturbance from human activity.
- Potential effects would occur to raptors and other birds from the tram conveyance system, especially at the Chulitna River crossing.

- Impacts would occur from the transmission of additional power.
- The aesthetic qualities of "undisturbed" wilderness would be affected.

Construction impacts

- Construction of this alternative would disturb critical bear use and denning areas, non-habituated wildlife populations, raptor habitat, moose, swan habitat, and migrating fish populations.
- Construction disturbance to vegetation would include: influences to wet and dry tundra, and riparian habitat adjacent to the Chulitna river corridor. Disturbance would occur mainly at support structure sites and at base areas. Potential sedimentation in the Chulitna River and other wetlands during construction could affect fisheries and aquatic habitat.
- Probable effects to archaeological resources would occur.
- At least two seasons of wildlife disturbance and displacement would occur during construction.
- Water quality impacts, noise, equipment emissions, and impacts from construction staging activity along the tram corridor could be minimized by sensitive construction methods.

Compliance

- An environmental impact statement would be required for this alternative with emphasis on wilderness encroachment, disturbance to significant wildlife habitat during construction, and permanent changes to wilderness aesthetics.

Appendix 5: Dust Abatement Product Evaluations

MEMORANDUM

TO: Russ Berry and Maintenance Staff / Denali National Park
FROM: Dave Rieseck / Dames & Moore (BRW Transportation Study Team)
DATE: 14 August 1992
SUBJECT: Denali Road-Surface Treatments

During our meetings in June, you mentioned that some information on bonding material options for road coating might be helpful to your maintenance staff. The following pages describe various products we evaluated for roads in the Pike National Forest and Holy Cross Wilderness areas of Colorado. Both projects had tremendous freeze/thaw, heavy vehicle and perma-frost considerations.

The following products are some of the most widely used materials for dust abatement and erosion control on unpaved roads. Each product offers a variety of application methods that depend on the end use, surface aggregate size, and percent fines and clay in the road base. Application is also site specific in that sharp curves and steep road segments may require more intensive treatments than flat, straight road segments. Use of magnesium or calcium chloride, although cost-effective, should be applied with extreme care due to its effect on roadside vegetation. Because the chlorides are salts, they act as defoliants when in contact with plant foliage and hold soil water from plant roots. Further recommendations for specific application to the Denali road would require information and input from product representatives concerning:

-soil moisture condition over the roadbase
-roadbase texture and gradation of surface material (sieve analysis)
-aggregate size
-traffic volume and load (ADT count)
-atterberg limit
-uniformity of surface
-average gradient/steepest gradient and switchback geometry

[illegible]

Product: **COHEREX**

Supplier:
Cobitco, Inc
Denver, CO
Doug Martin 303/296-8575

Type/Composition:

Emulsified Petroleum Resin

Description/Comments:

The resins are the dust binding portion; a wetting solution serves as the carrying and penetrating agents and keeps the resin particles finely dispersed. This resin-based product coats the surface and acts as a binder for the soil particles (does not create a hardened crust). Provides protection against wind erosion. Provides good control even under light and infrequent traffic and keeps its integrity through the winter and after precipitation events. Claims to be stable for up to 3 years when surface application is on undisturbed areas. Protects against water erosion with the exception of heavy rains when erosion sometimes occurs at places where the crust has been disturbed (typically by deer or elk).

As a surface application it is recommended for use on revegetated hillsides and light traffic roads. For long-term results and use on heavily travelled roads it needs to be mixed into the top 2-3" of the road base (loosen road surface, pre-wet, apply Coherex, mix, spread, roll). Will not re-wet and leach out after incorporation into road.

Coherex is claimed to be non-toxic to humans, animals, and plants, however, one representative reported that it contains a carcinogenic resin.

Rate of Application:

Dilute with water at 4 to 10 parts water to 1 part of concentrate. Diluted solution is applied at a rate of approximately 1/2 gallon per square yard. Applied through conventional water truck.

Cost:

For 200 gallons or more price is $0.98/gallon F.O.B. Denver. Approx $0.05/SY to $0.10/SY.

Product: **DUSTROL 350**

Supplier:
O'Brien Industries, Inc
2682 Lisbon Road Cleveland, OH 44104
Jim Zinkan 216/487-1500

Type/Composition:

Stable emulsion of semi-liquid petroleum resins and a wetting solution plus sequestering agents

Description/Comments:

The resins are the dust binding portion, the wetting solution serves as the carrying and penetrating agents and keeps the resin particles finely dispersed; the sequestering agents are incorporated to allow Dustrol 350 to be mixed with hard or soft water. Dustrol coats (not really a crust) the surface and provides protection against wind erosion. Provides good control even under light and infrequent traffic and keeps its integrity through the winter and after precipitation events. Claims to be stable for up to 3 years when surface application is on undisturbed areas.

As a surface application it is recommended for use on revegetated hillsides and light traffic roads. For long-term results and use on heavily travelled roads it needs to be mixed into the top 2-3" of the road base (loosen road surface, pre-wet, apply material, mix, spread, compact). Will not re-wet and leach out after incorporation into road.

Dustrol 350 is claimed to be non-toxic to humans, animals, and plants.

Rate of Application:

Dilute with water at 4 parts water to 1 part Dustrol. Apply diluted mixture at 1/2 gallon per square yard. Product is sticky and requires some additional effort to clean it off of the water truck or other surfaces it may contact.

Cost:

Price F.O.B. delivered out of Distributor in Denver - $2.00/gallon

Product: **MARLOC**

Supplier:
Buckley Powder Co.
42 Inverness Drive East   Englewood, CO 80122
Lee Johnson   303/790-7007

Type/Composition:

Hydrophilic Waterborne Copolymer Emulsion

Description/Comments:

Develops a "plastic-like" coating over the soil surface. Allows the exchange of air and moisture, tends to reduce moisture evaporation at the soil surface and is resistant to freeze-thaw. Claims to be effective on temporary roads. Can be applied through conventional water truck or hydroseeder. Effective life of one year.

Surface application is recommended only for untravelled areas and hillsides. For use on heavily travelled areas Marloc should be mixed into the upper 3" of the road base to be effective.

Marloc is claimed to be non-toxic to humans, animals, and plants.

Rate of Application:

Apply diluted with water at a rate of approximately 20 to 30 parts water to 1 part Marloc. Dilution approximately 20 to 30 parts water to 1 part Marloc. Dilution rate of 1:1 may be used where traffic may be active. Product (concentrate) application rate of approximately 50 gallons per acre.

Cost:

Prices for product in 50 gallon drum F.O.B. Louviers, CO or Phoenix, AZ.
$11.00/gal up to 450 gallons
$10.00/gal 500 to 2450 gallons
$ 9.00/gal over 2500 gallons

@30:1 - price for up to 2500 gallons = $0.10/SY

Product: **ROAD-OYL**

Supplier:
Soil Stabilization Products Co., Inc.
P.O. Box 2779 Merced, CA 95344
Bob Randolph 209/383-3296

Type/Composition:

High bonding strength emulsion formulated with pitch and resin, ingredients derived from natural pine tar (lignin).

Description/Comments:

Used primarily for dust control on haul roads. Some road base preparation required. Road-Oyl has the ability to work without the presence of cohesive binder and without the need for high "fines" content in the soil. It is recommended for well graded aggregate with 3-5% fines. Bonding strength comparable to normal asphalt products. Also prevents water erosion from runoff. Duration/effectiveness unknown.

Recommended for use on light and heavy traffic roads. On straight, flat road segments surface application should be adequate, on switchbacks Road-Oyl should be worked into the road base.

Road-Oyl is claimed to be non-toxic to humans, animals, and plants, however, one representative reports that a brown liquid leaches from the application and stains surrounding land surfaces and surface waters.

Rate of Application:

Diluted with water, product is applied at rates of 0.2 to 0.3 gallons of concentrate per square yard. Can be applied by a conventional water truck.

Cost:

Delivered in 6,000 gallon tanker F.O.B. Denver ~ $2.00/gal.
Approx. $0.40/SY to $0.60/SY

Product: **DUS-TOP**

Supplier:
WRR Industries, Inc.
P.O. Box 27597 Salt Lake City, UT 84127
Mary 1-800-672-6025

Type/Composition:

Magnesium Chloride (Salt)

Description/Comments:

Magnesium Chloride based product in liquid form that absorbs moisture from the air and holds it. Used primarily for dust control on haul roads. Base material must have sufficient 3/4" minus aggregates and fines to ensure proper binding. Road base also requires preparation to allow for the incorporation of the product up to 3" deep and compaction after application is recommended. Claim one application per year is adequate under normal conditions.

Recommended for light and heavy traffic roads.

Similar to calcium chloride in detrimental effects to vegetation. Each are salts and act as a defoliant when accumulated on plant leaves and out competes plant roots for moisture from the soil. Not as corrosive as calcium chloride.

Rate of Application:

Typical application rate of 1/2 gallon per square yard. Recommend application using a pressurized distribution spreader or water truck equipped with a spray bar, as opposed to splash plates. Shipped ready to apply; no dilution required.

Cost:

$30/Ton FOB Salt Lake City, UT
Freight costs will be higher than other products since it is not a concentrated product.

Product: **SOIL SEAL**

Supplier: Soil Stabilization Products Co., Inc.
P.O. Box 2779 Merced, CA 95344
Bob Randolph 209/383-3296

Type/Composition:

Forms a crust through the cohesive binding of the surface soil particles. To be used on areas that will not receive traffic. Can last up to 18 months between applications if crust is not disrupted. Soil Seal will also act to prevent water erosion and will not affect vegetation. In fact it can be added with seed and/or mulch for hydroseeding.

Recommended for use on hillsides and stabilizing other untravelled areas.

Soil Seal is claimed to be non-toxic to humans, animals, and plants.

Rate of Application:

Applied diluted with water at the rate of 30 to 40 parts water to 1 part Soil Seal. Product application rates range from 60 gallons of product per acre to 160 gallons/acre depending on slope, soil type, and degree of compaction. Typical application is through a water truck.

Cost:

Prices based on delivery in 50 gallon drums F.O.B. California.
$11.35/gal up to 450 gallons
$11.20/gal 450 to 2500 gallons
$11.05/gal 2500 to 10,000 gallons
Per quote for over 10,000 gallons

@ 30:1 - price for up to 2500 gallons $0.13/SY to $0.37/SY

Product: **SOIL MASTER WR**

Supplier: Earth Systems International, Inc.
4065 North Sinton Rd. Colorado Springs, CO 80907
Dwayne Black 719/634-6663

Type/Composition:

Tripolycate-based material formulation

Description/Comments:

Forms a crust through the cohesive binding of the soil particles. Crust thickness varies between 1/4 to 1/2 inch depending on soil conditions, application rate and dilution ratio. Not generally considered to be an economical solution for dust control for areas of moderate to heavy traffic -- either vehicular or pedestrian. Can last up to 18 months between applications if crust is not disrupted. Soil Master will also act to prevent water erosion and will not affect vegetation. In fact, it can be added with seed and/or mulch for hydroseeding.

Claimed to be non-toxic to humans, animals, and plants.

Rate of Application:

Applied diluted with water at the rate of approximately 30 parts water to 1 part Soil Master. Product application rates range from 60 gallons of concentrate per acre to 150 gallons/acre depending on slope, soil type, and degree of compaction. Typical application is through a water truck.

Cost:

$7.00/gallon F.O.B. California although ESI may pay shipping costs.
@ 30:1 $0.09/SY to $0.22/SY

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Product: **SOIL MASTER WR-II: A & B System**

Supplier: Earth Systems International, Inc.
4065 North Sinton Rd. Colorado Springs, CO 80907
Dwayne Black 719/634-6663

Type/Composition:

Tripolycate-based material formulation

Description/Comments:

Soil Master WR-II is packaged in two liquid forms, A and B, then diluted with water in the field for application. It is recommended for secondary road use, helicopter pads, and temporary airfield landing strips. This is a more concentrated version and intensive application procedure than Soil Master WR.

A good deal of road base preparation is required for this product. The road base is loosened (3-12" depending on end use results), material applied, surface graded then compacted, and the final treatment applied. The compaction procedure will vary depending on moisture content, stability, and layering.

Claimed to be non-toxic to humans, animals, and plants.

Rate of Application:

A typical dilution ratio is 3,600 gallons of water to 440 units of WR-II per acre for secondary road use (based on 3" lift of native soil). Application ratios will vary depending on road base conditions, penetrations, and end use results. Material application should be performed by use of a spreader tank truck with agitator.

Cost:

$7.00/gallon F.O.B. California although ESI may pay shipping costs.
@ 30:1 $0.09/SY to $0.22/SY

Product: **DUSBLOC 310**

Supplier:
Chemlink
Glenn Mead
505/326-4725

Type/Composition:

Partially neutralized lignin liquor concentrate/spent sulfite liquor

Description/Comments:

Scarify road to a depth of 3", blading aside aggregate larger than 1" in diameter. Deeper grading may be required if road is severely rutted or potholed. Blade loose aggregate into windrows on side of road.

Dilute 4.5:1 (water:product). 1/2 to 1/3 of solution is applied to soil between windrows, blade into roadway, blade mixed with binder and spread evenly across width of road. Another 1/3 of the solution is applied to the freshly graded area. Crown the road surface at 1/2" per foot from centerline to edge for proper drainage.

Apply final top dressing and compact with multiple wheel, rubber tire roller.

Claims to have no known significant hazards. Fish toxicity data state a Flathead minnow static acute LC-50 < 1000 ppm.

Rate of Application:

Dilute DUSBLOC 310 4.5:1 (water:product) and apply with water distributor truck at 0.5 gallons per square yard.

Cost:

$0.93/gallon F.O.B. Colorado Springs

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Appendix 6: Stampede Road and Railroad Feasibility Analysis

ALTERNATIVE MODES FEASIBILITY STUDY

TECHNICAL MEMORANDUM

DENALI NATIONAL PARK AND PRESERVE

Stampede Road and Railroad Feasibility Analysis

May 17, 1994

INTRODUCTION

This technical memo documents a study of the feasibility of constructing an alternative access into the Kantishna area of Denali National Park from the George Parks Highway, generally following the route of the old Stampede Road, and to identify the likely costs and construction requirements for such a facility. The work was carried out during September to November 1992 in connection with the Alternative Modes Feasibility Study being completed by BRW for the National Park Service (NPS).

ALTERNATIVES

The alternatives evaluated as part of this study include a roadway and a rail line, both of which have recently been proposed by others. The attached map illustrates the approximate alignment of each alternative in relation to the park overview.

ROADWAY ALTERNATIVE

Approach

The conceptual alignment for the roadway alternative was developed following review of available materials including USGS topographic maps, USGS Satellite Image maps depicting landforms and general vegetation types, and plans of the existing park road. Telephone and/or in-person interviews were held with staff from the National Park Service at Denali, the Federal Highway Administration in Vancouver, Washington and the Alaska Department of Transportation and Public Facilities in Fairbanks, to gather information on previous investigations of this corridor, design practices, problem areas, and cost experience. Following development of a tentative alignment on 1" = 1 mile scale USGS topographic maps, an aerial reconnaissance was conducted on September 3, 1992. Refinements were then made to the alignment based upon the field observations.

Alignment Description

The proposed conceptual alignment follows the general alignment of the "existing" Stampede Road from its starting point at the George Parks Highway (State Highway 3) near Lignite, to its end in the vicinity of the old Stampede Mine near the confluence of the Clearwater Fork and the main stem of the Toklat River approximately 40 miles west of Lignite. (See Exhibits PPM-1 through PPM-6)

Beyond the Stampede Mine, the route ascends through the valley of the Clearwater Fork and Myrtle Creek to a divide east of Spruce Peak. Beyond this point the route descends along Willow Creek and the north fork of Moose Creek through Upper Canyon to a junction with the existing park road approximately three miles east of Kantishna.

The total length of the alignment is 78 miles. The following paragraphs describe the primary features of each segment of the proposed roadway.

Highway 3 to Eightmile Lake - This portion of the route follows the existing Stampede Road and is passable to normal passenger and commercial vehicles depending on seasonal maintenance. Summer maintenance reportedly keeps the road open to Mile Post 8.0; winter efforts keep the road open to MP 3.4. The road is a narrow two-lane facility which has an all-weather gravel surface. The width and condition of the roadway deteriorates towards the westerly end. The present road serves scattered residential development in the first few miles west of State Highway 3

The route crosses generally dry tundra. Scattered areas of moist tundra are found adjacent to streams and in upland locations.

Eightmile Lake to Stampede Mine - This portion of the route includes approximately 32 miles of a "track" west of Eightmile Lake.

The track is negotiable only at best by four wheel drive or "off-road" type vehicles. The "track" was apparently developed to take advantage of the relatively favorable subgrade conditions found within existing river bottoms and to maximize the use of glacial advance areas that contain better gravel-type material. In many of the river bottom areas the "track" has apparently been eradicated by river flow and is no longer discernable from the air. These areas include sections at the confluence of the Savage and Teklanika rivers, along the east fork of the Sushana River, the east fork of the Toklat River, and along a five mile reach of the main stem of the Toklat and a four mile reach of the Clearwater Fork adjacent to the confluence of those two waterways.

In this section, the new alignment avoids the river bottom locations cited above and follows a routing that would take advantage of anticipated favorable subgrade conditions found in the granular bench areas adjacent to the rivers, but would be elevated sufficiently above the river bottom itself to avoid inundation during periods of high flows.

Major drainageway crossings in this section include Fish Creek, the Savage River, the Teklanika River, the Sushana River and tributaries, the East Fork and main stem of the Toklat River, and Little Moose Creek. Like the previous section, the route generally crosses dry tundra, with scattered areas of moist tundra adjacent to streams and rivers, and isolated upland locations.

Stampede Mine to Myrtle Creek/Willow Creek Divide - The route in this section follows the valley of the Clearwater Fork of the Toklat River for approximately twenty miles to a divide east of Spruce Peak. The roadway would ascend approximately 1,000 feet in this section from the Stampede Mine to its high-point at the Myrtle/Willow divide, and would be located on granular benches above the creek or in sidehill locations as necessary to take advantage of favorable subgrade conditions and topography.

The alignment shifts from the west to the east side of the Clearwater Fork in several locations to take advantage of favorable topographic conditions. Major drainageway crossings in this section include two crossings of the Clearwater Fork itself, Canyon Creek, Moonlight Creek, and an unnamed creek draining the south flank of Kankone Peak.

It appears that the route along the Clearwater Fork, Myrtle Creek, and the following section along Willow Creek will cross more areas of moist tundra in areas adjacent to and above the creeks than in the previous sections.

Myrtle Creek/Willow Creek Divide to Park Road - This section of the proposed route descends from the divide following Willow Creek, and the north fork and the main stem of Moose Creek to a junction with the existing park road approximately two miles north of Wonder Lake and three miles southeast of Kantishna. The gradient of the Willow Creek drainage is somewhat steeper than that of Myrtle Creek and the alignment is configured to keep roadway grades at 6% or less and generally lies on the north and

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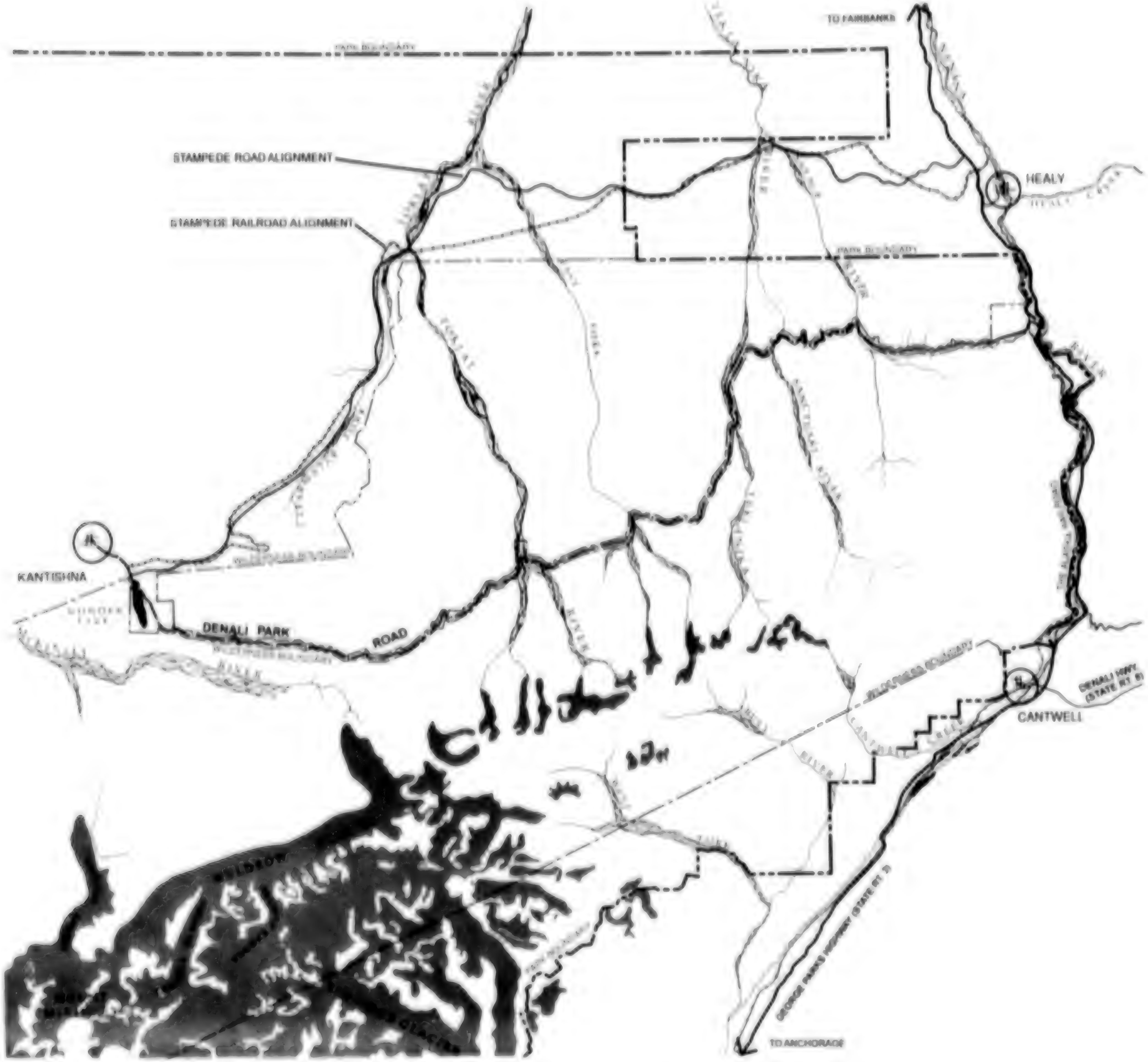
STAMPEDE ROAD AND RAILROAD ALTERNATIVE ALIGNMENTS



0 1 5 10 MILES

N

D E N A L I

NATIONAL PARK AND PRESERVE

ALTERNATIVE TRANSPORTATION MODES FEASIBILITY STUDY

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE [illegible]

west side of the valley. As in other sections, the alignment would be located to take maximum advantage of favorable subgrade conditions. Major drainage crossings in this section would include Spruce Creek, Glenn Creek, Dry Creek, and Rainy Creek.

Roadway Geometric Criteria

The 1990 AASHTO Policy on Geometric Design of Highways and Streets, the "Green Book", was used as the basis for the geometric design criteria. AASHTO design criteria was verified for compliance with the "Park Road Standards" developed by the National Park Service in 1984. The proposed road is classified as a "Special Purpose Recreational Road - Primary Access Road", which is defined as a road that would allow through movement into and between access areas.

- The proposed roadway would have an all weather gravel surface that could be paved with asphaltic material at a later time if desired.

- The desirable design speed for this road would be 40 mph. Design vehicles are assumed to include standard passenger vehicles, buses, motor homes, and vehicles with trailers, as would be common in access to a major recreational facility.

- A stopping site distance of 275 ft. (applicable to 40 mph) would be maintained by limiting the K value (algebraic difference in grade, multiplied by the length of the vertical curve) to 60. A maximum grade of 6% would be maintained, while the maximum allowable would be 9% (for rolling terrain at 40 mph). The minimum passing site distance would be 1500 feet.

- By using horizontal curves with a minimum of 955 foot radius, the need for superelevation of the road cross-section would be eliminated. It is anticipated, however, that actual field conditions may restrict the use of large radii and allow only short 200 ft. - 300 ft. radius curves in some cases. Superelevation would then be required as well as a reduction in design speed.

- It is anticipated that turnouts would be provided for viewing at intervals along the roadway. Turnouts would be 10-25 ft. wide and 50-100 ft. long, with 25-50 ft. tapers on each end. No special provision was made in the cost estimate for visitor interpretation or other visitor services. It is likely that additional costs would be associated with such facilities were the road or railroad to be implemented.

- The established minimum cross-section requirements relate to an average daily traffic volume in the range of 1,000 to 4,000 vehicles. One thousand daily vehicle trips is equivalent to approximately one half the existing peak month average daily traffic on George Parks Highway, or the number of two-way private vehicle trips generated by the total daily passengers currently using the NPS shuttle service in the park road corridor. Development policies for Kantishna would dictate certain trip demands on Stampede Road.

- The roadway cross-section contains two 11 ft. travel lanes with a 3 ft. shoulder on each side. The cross-slope would be 3% with a center crown, with a 4 ft. foreslope at 4:1, and a 3:1 back slope to a catch point (top of cut or toe of fill). (See Stampede Road, Typical Section.)

- Roadside barriers, except for bridge railing and guardrail at bridge approaches, would generally not be used in order to provide a more natural driving experience and less intrusion into the environment. Review of site specific slope and hazard conditions would have to be addressed in preliminary design.

- Bridges and culverts will be designed in accordance with AASHTO Standard Specifications for Highway Bridges. The minimum loading for the new bridges should meet HS-20 criteria.

Roadway Construction

The roadway was laid out on Alaska 1" = 1 mile scale U.S.G.S. quadrangles, with a contour interval of 100 ft. in elevation. The horizontal alignment was digitized into a computer aided design format. The contours within a 10,000 foot wide corridor were digitized, and a terrain model was generated. The horizontal alignment was refined based on the horizontal criteria outlined above. A profile was interpolated from the terrain model and a conceptual proposed vertical alignment was laid out based on the vertical geometry criteria outlined above. The following conditions were assumed for estimating purposes:

- With an average width of 72 ft. of impacted area to be cleared and grubbed and a road surface width of 28 ft. from shoulder to shoulder, a 44 ft. strip of top soil and tundra (22 ft each side from the roadway) would remain that will need to be reclaimed after construction to minimize construction scar impact. (See Stampede Road Typical Section.)

- It has been assumed, based upon discussions with park management personnel, that the creation of borrow areas and spoil sites outside of the construction zone within the park would not be allowed. Therefore the hauling of materials is a major portion of the cost of this project. Construction material including embankment, surfacing, and subgrade has to be hauled an average of 39 miles from the road entrance to the centroid of the project. Spoil from subgrade overexcavation is assumed to be wasted on site in the area between the shoulder and the limit of clearing and grubbing. An allowance for revegetation has been included in the cost estimate. It is assumed that another five miles of haul from the entrance of the Stampede Road (at State Highway 3) to a borrow site would be required as well. Further evaluation of borrow sites will be required as part of subsequent work. The location of these sites could have a substantial impact on the cost of material hauling for the project.

- The condition of the subgrade, and the acceptability of the existing soils to serve as a structural base for the new roadbed, is the most significant single factor in the assessment of the roadway's cost. The degree to which it becomes necessary to remove and replace existing underlying soils will have the greatest impact on the total cost. Subexcavation for the removal of poor, wet soils, haul, and disposal of these soils, borrow of good quality structural backfill and the expected lengthy haul requirements to obtain backfill outside of the park boundaries all contribute to a very expensive roadbed construction operation.

- Subexcavation of poor soils and replacement with higher quality gravel type material to a depth of two feet is assumed for the entire length of the Stampede Road, west of Eightmile Lake. (This involves approximately 70 miles of roadbed construction.) The two foot depth is selected only as an average and as a gross representation of the conditions and methods expected for the entire roadway. It is acknowledged that the actual depth of removal and replacement could extend much deeper, to five or ten feet, however, it is also anticipated that existing soils will suffice as the roadway subgrade in many places.

- The incorporation of a geotextile reinforcement material into the roadbed design is also assumed to provide enhanced load support capability of the subgrade. Use of a geotextile geogrid is recommended to provide internal reinforcement of fill materials, bridging over of soft soils, distribution of loads over a wider area of soft subgrade, and to reduce rutting. The use of a geogrid will be a key component in the stabilization of the roadbed over any segments with poor underlying soils; it will not be essential in any areas where a good gravel type material exists on which to build. For purposes of cost estimating, use of a geogrid is assumed for 48 feet of width under 60% of the roadway, or 47 miles. Experimentation with the geogrid should be performed prior to any full scale use, since it may be possible to reduce or eliminate the subexcavation requirements accordingly.

Bridge Construction

Bridges will be required to span all major waterways and several lesser waterways as well. Bridge lengths were estimated, where possible, from the length of structures upstream on the existing park road. A total of 10 bridge structures with a total length of 5,150 feet was estimated. Overall bridge width for estimating was assumed to be 31.5 feet, providing a 28 foot roadway. BRW met with Federal Highway Administration bridge staff in the Denver Central Federal Lands Highway Division office to view plans of recently constructed existing Denali National Park road bridges and to discuss bridge types, special problems and construction cost experience. Additional bridge cost and type selection data pertinent to this region of Alaska was obtained from the Chief Bridge Engineer of the Alaska Department of Transportation and Public Facilities. Based upon these discussions, the following conclusions were drawn:

- A relatively wide variety of conventional bridge types have successfully been constructed in this region. The Federal Highway Administration has employed both steel plate girder/concrete deck bridges and cast-in-place concrete box girder bridges on the existing Denali access road. The Alaska DOT has found that full precast deck bulb tee bridges are most economical for spans in the 100' to 150' range, with steel plate or steel box girder bridges preferred for longer spans.

- For the purpose of developing preliminary cost estimates, it has been assumed that most bridges will consist of multiple spans, each of 150' or less. This will permit the construction of relatively economical short-span deck bulb tee or steel plate girder superstructures. While there is considerable variation in the square foot construction costs of similar bridges, as reported by both the Federal Highway Administration and Alaska DOT, a cost of $125/SF was chosen as most representative of the site and construction conditions.

- Bridge lengths were estimated from USGS maps and, when available, existing upstream crossings. A preliminary hydrologic/hydraulic reconnaissance will be required to refine these lengths.

Roadway Alternative Cost

The attached tables provide a summary of the cost estimate for the Stampede Road to Kantishna. Including provisions for planning and design costs (25% of net), 16% (of net) for contingencies and 15% (of net) for supervision, the total estimated cost of the road is just over $168 million.

RAILWAY ALTERNATIVE

Approach

The conceptual route for the railway alternative is based upon an alignment developed by a proponent of the project. The alignment was developed on 1" = 1 mile scale topographic mapping and follows the same general route as the roadway alternative described above. Because of an assumed grade limitation of one %, the railway alignment is somewhat more circuitous than the roadway alignment with switchbacks and other out-of-direction segments required to maintain grade. While the one % grade limitation applies generally to heavy haul freight railways, steeper grades may be acceptable for other uses such as passenger service. An option which could permit the use of the same grades as those used on the roadway could utilize a cog-type assist in steeper sections similar to that used on european mountain railways.

For purposes of this study the "Thomas" alignment utilizing standard gauge track was used as a basis for cost estimating.

Railway Construction

The railway typical section includes a single standard gauge track on timber ties and ballast. A 500 ft passing siding is assumed at 10 mile intervals. The total graded section is 28 feet wide for single track and 43 feet wide for double track as shown in the attached railroad cross sections. Grading assumptions and material haul assumptions are the same as those applied to roadway construction. The railway typical section would have a lesser impact and lesser material requirements than the roadway section due to its narrower width. Grade limitations, however, would result in deeper cuts and fills in some locations.

Total length of the railway alignment is 86 miles.

Bridges

Bridges for the railway would be required at approximately the same locations as for the roadway. Open-deck timber trestles would probably be adequate in most locations and would have a more "natural" appearance. At major waterways, longer spans to pass flood flows would require concrete or steel construction.

Single track bridge widths would be about 15 feet and would include a trainman's walk on one side. Based on experience elsewhere, an average bridge cost of $200 per square foot was assumed for estimating purposes.

Railroad Alternative Cost

The attached tables document the cost estimate for the Stampede Railroad. Including provision for planning and design costs (25% of net), 16% (of net) for contingencies and 15% (of net) for supervision, the total cost of the railroad alternative is estimated to be just over $213 million.

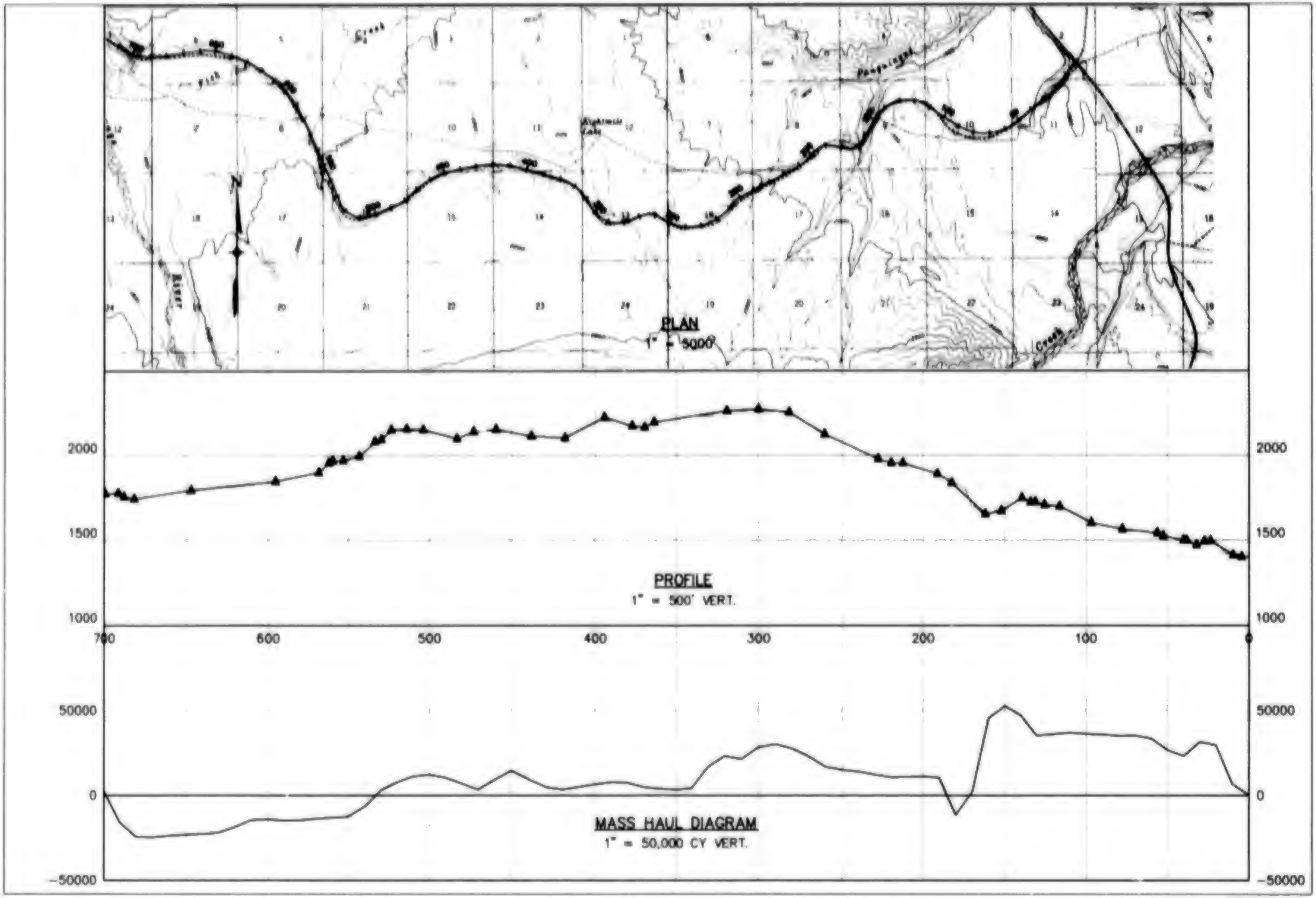
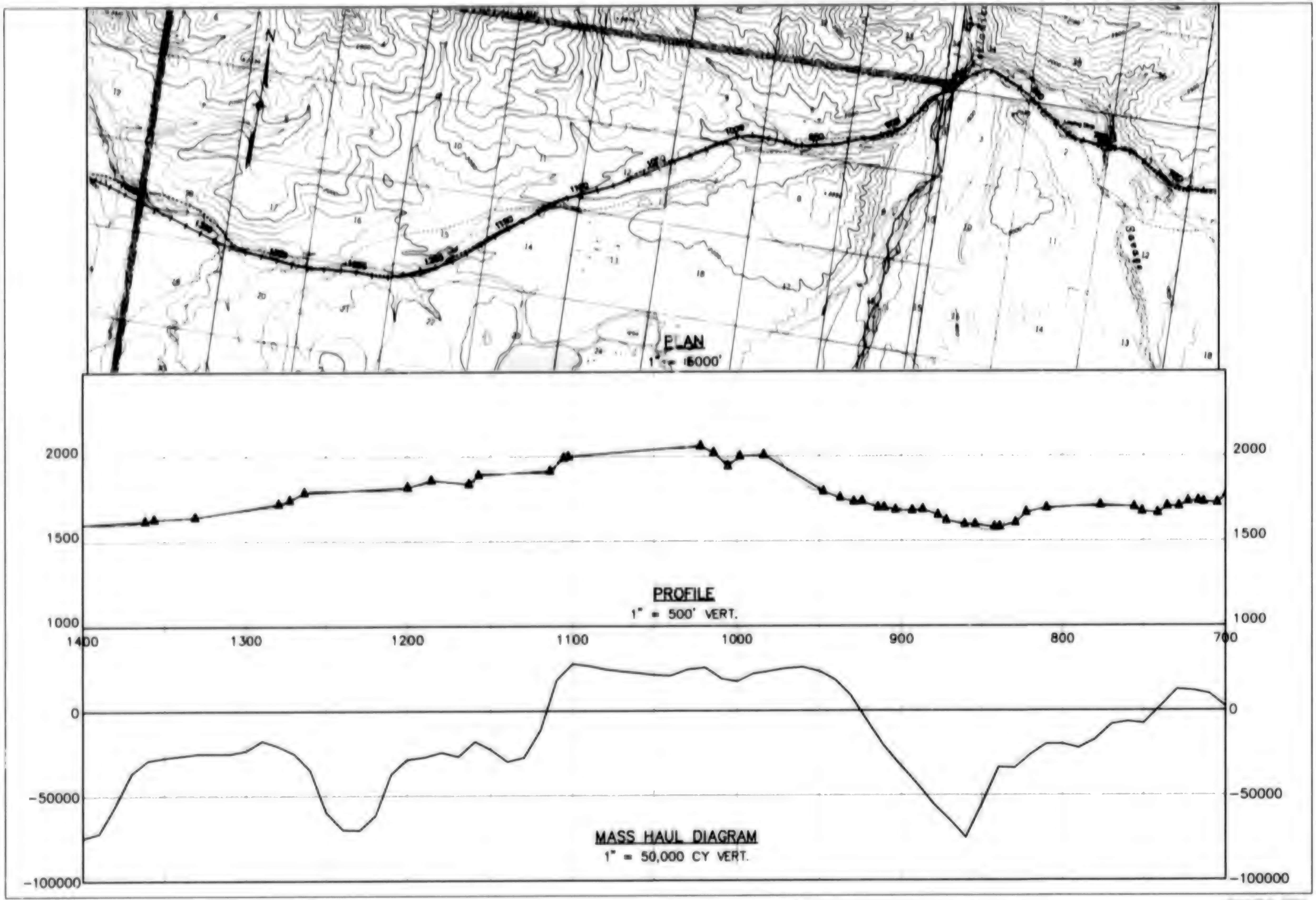


EXHIBIT PPM-1



PLAN
1" = 16000'

PROFILE
1" = 500' VERT.

MASS HAUL DIAGRAM
1" = 50,000 CY VERT.

EXHIBIT PPM-2

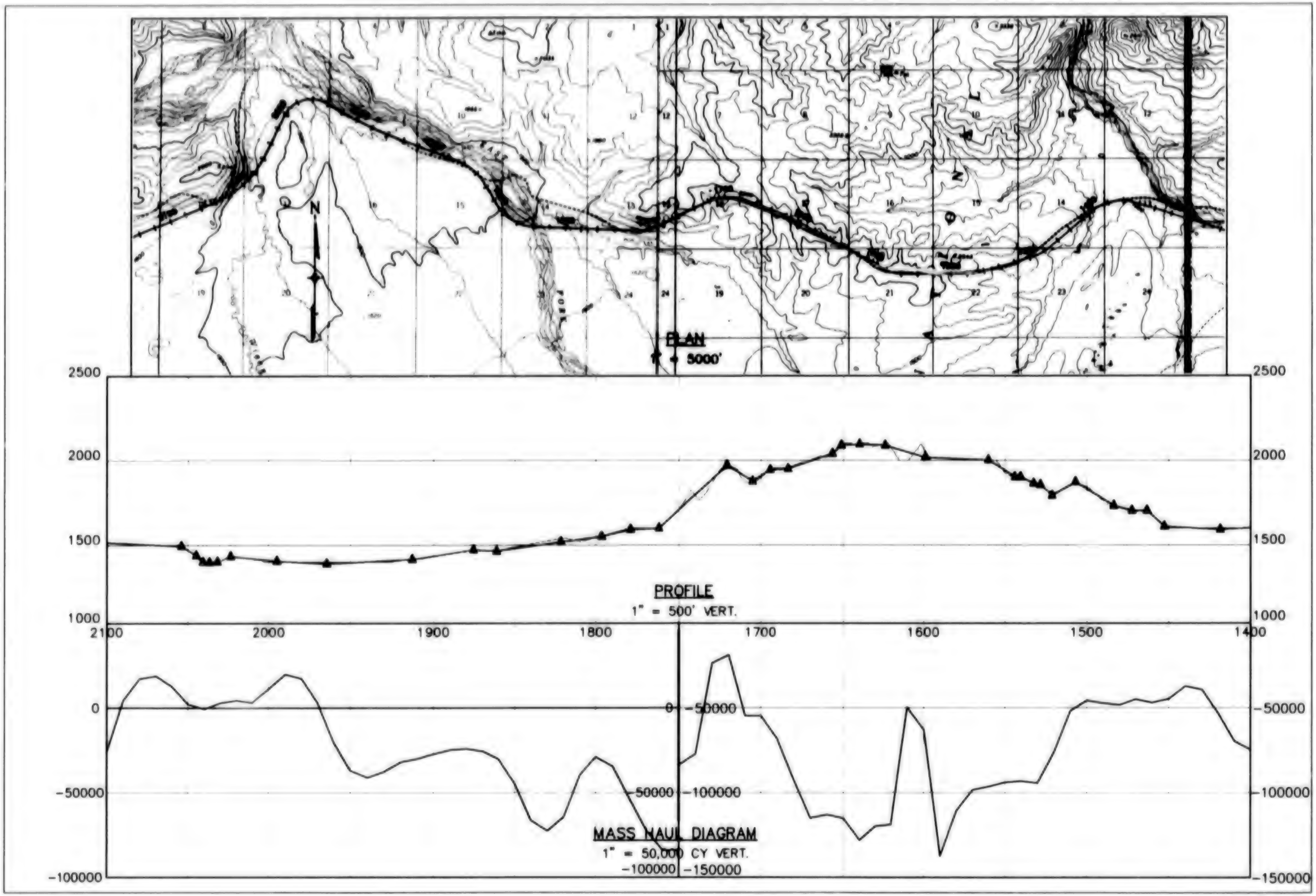


EXHIBIT PPM-3

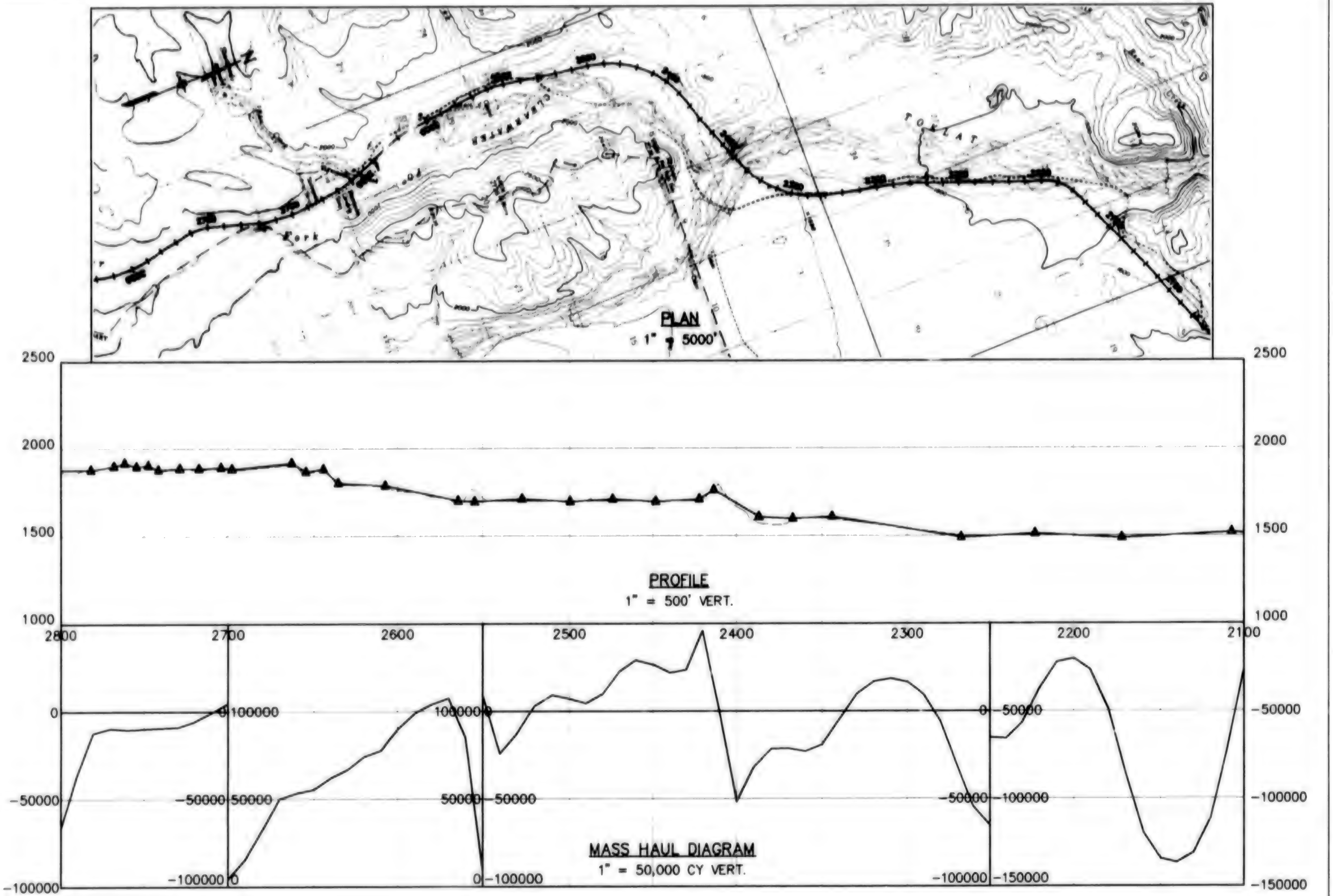
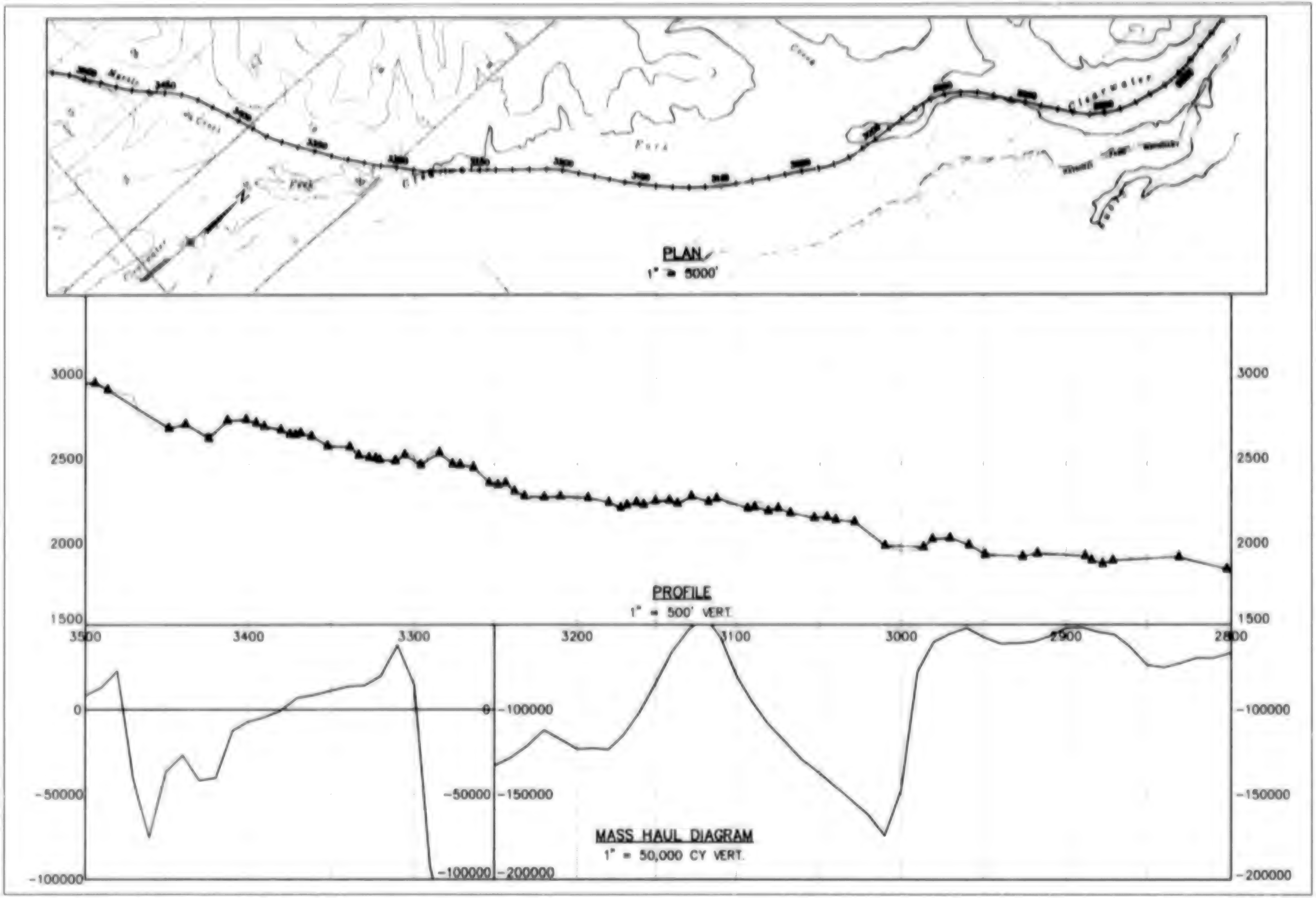


EXHIBIT PPM-4


PLAN
1" = 5000'

PROFILE
1" = 500' VERT.

MASS HAUL DIAGRAM
1" = 50,000 CY VERT.

EXHIBIT PPM-5

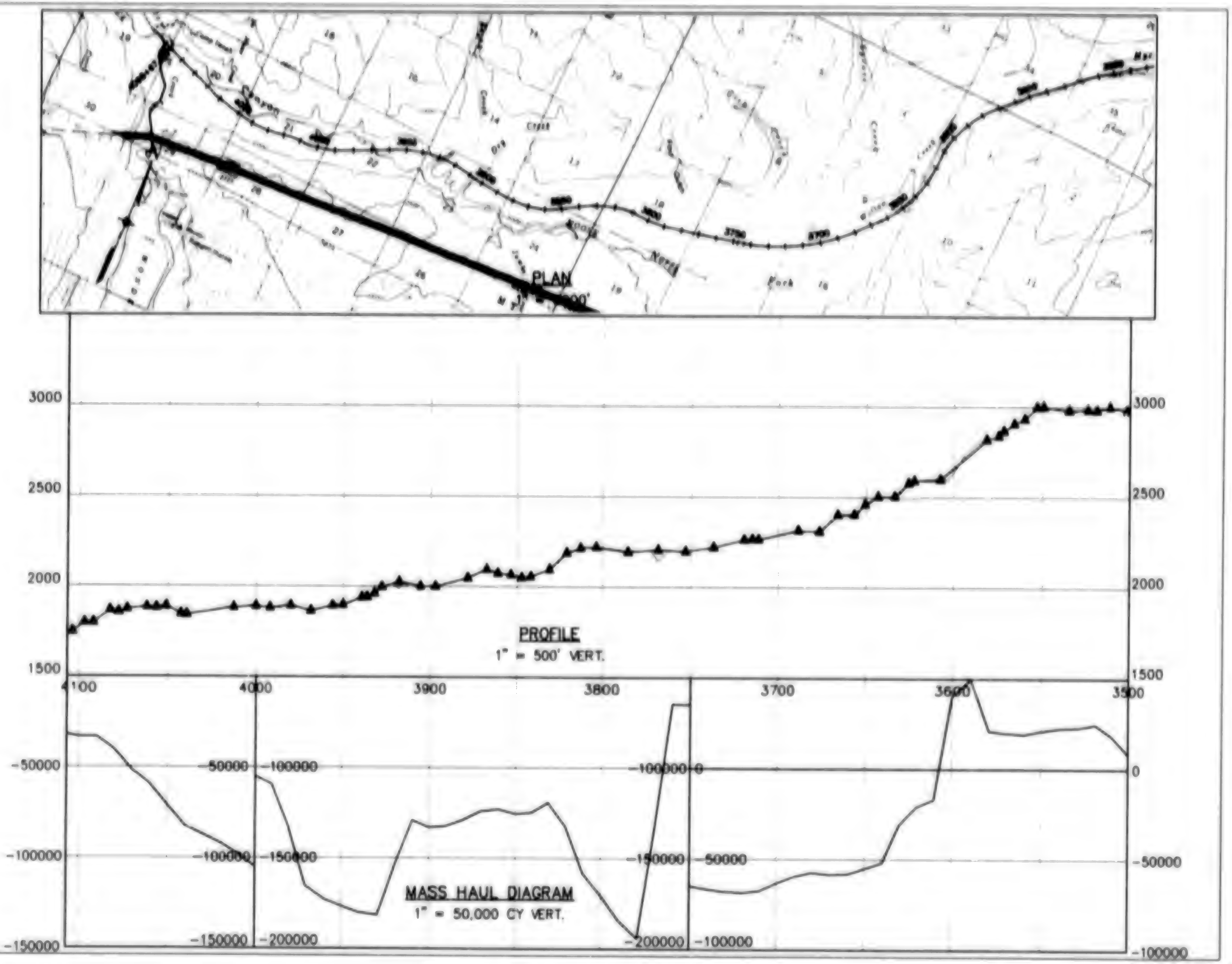
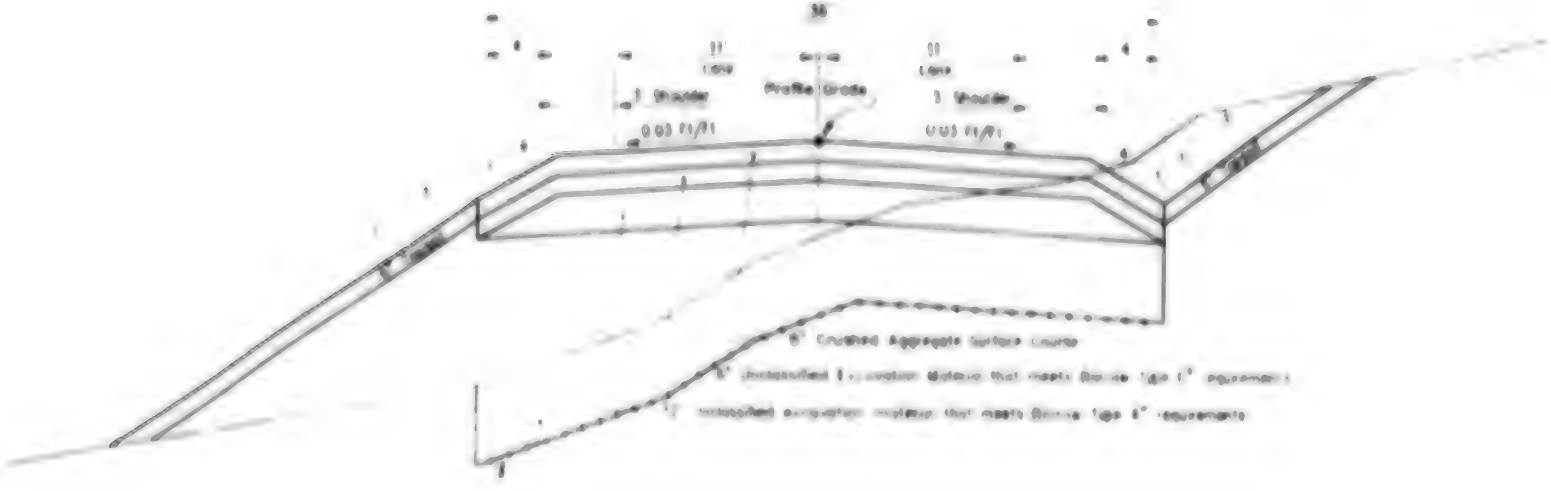


EXHIBIT PPM-6

STAMPEDE ROAD
TYPICAL SECTION


38'
11' Lane
11' Lane
3' Shoulder
3' Shoulder
Profile Grade
0.03 Ft/Ft
0.03 Ft/Ft
6" Crushed Aggregate Surface Course
8" Unclassified Excavation Material that meets Borrow Type C' requirements
12" Unclassified excavation material that meets Borrow Type A' requirements

18' Subexcavation – Removal of poor soils & replace with unclassified excavation material that meets Borrow Type A' requirements

Geotextile reinforcement

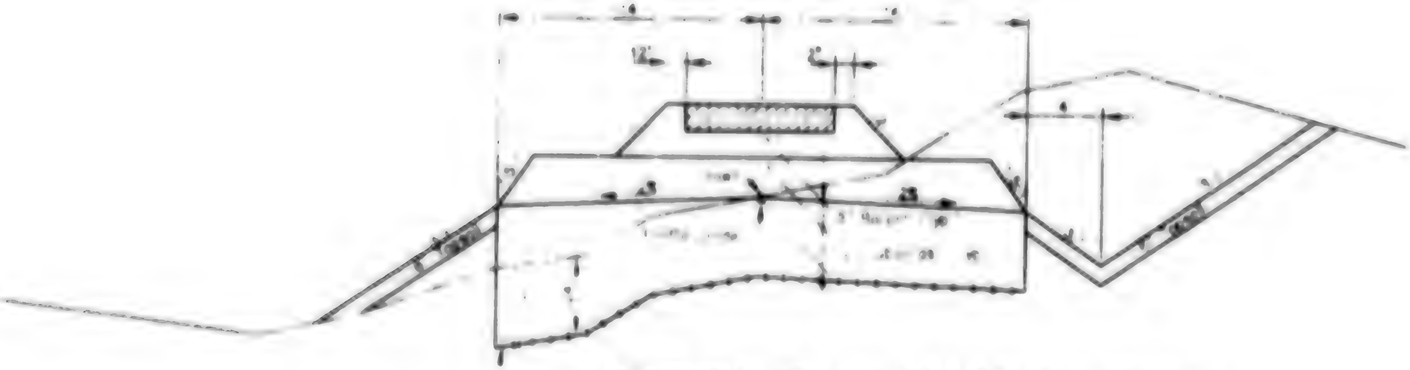
Stampede Corridor Roadway Cost Estimate

ITEM #	PAY ITEM DESCRIPTION	PAY UNIT	UNIT COST	QUANTITY	EXTENSION
114(1)	CONSTRUCTION SURVEY BY THE CONTRACTOR	LUMP SUM	$3,500,000	1	$3,500,000
116(1)	FURNISHING AND MAINTAINING FIELD OFFICE	LUMP SUM	$25,000	1	$25,000
116(2)	FURNISHING AND MAINTAINING FIELD LABORATORY	LUMP SUM	$15,000	1	$15,000
116(3)	FURNISHING AND MAINTAINING CURING SHED	LUMP SUM	$5,000	1	$5,000
201(2B)	CLEARING AND GRUBBING	ACRE	$500	679	$339,500
203(3)	UNCLASSIFIED EXCAVATION	CUBIC YARD	$5	3,000,000	$15,000,000
204(1)	HAUL	C Y V M	$0.40	85,285,571	$34,114,228
304(1)	SUBBASE, GRADING A	TON	$7	981,223	$6,868,561
304(1)	SUBBASE, GRADING B	TON	$8	490,611	$3,924,888
304(4)	CRUSHED AGGREGATE SURFACE COURSE	TON	$15	534,877	$8,023,155
630(2)	GEOTEXTILE, REINFORCEMENT	SQUARE YARD	$2.50	1,323,520	$3,308,800
603(1 - 36)	36 INCH CORRUGATED STEEL PIPE	LINEAR FOOT	$65	24,000	$1,560,000
603(3 - 36)	END SECTION FOR 36 INCH CORRUGATED STEEL PIPE	EACH	$300	684	$205,200
616(1)	3/4 INCH DIAMETER CULVERT THAW PIPE	LINEAR FOOT	$6	24,000	$144,000
618(2)	SEEDING	ACRE	$900	415	$373,500
620(2)	SALVAGED TOPSOIL	M.S.F.	$100	18,090	$1,809,000
640(1)	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	$6,000,000	1	$6,000,000
	BRIDGES	SQUARE FOOT	$125	162,225	$20,278,125
	MAJOR CULVERTS	EACH	$60,000	38	$2,280,000
	NET COST	SUBTOTAL			$107,773,957
	SUPERVISION AND CONTINGENCY	PERCENT	31%		$33,409,927
	GROSS COST	SUBTOTAL			$141,183,884
	PLANNING	PERCENT	25%		$26,943,489
	TOTAL COST	TOTAL			$168,127,373

DESCRIPTION	COST
DEMOLITION & REMOVAL	$7,989,000
GRADING AND DRAINAGE	$54,178,428
STABILIZATION	$24,278,404
MAJOR STRUCTURES	$21,328,125
SUPERVISION AND CONTINGENCY	$33,409,927
PLANNING	$26,943,489
TOTAL COST	$168,127,373

Note: – Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

STAMPEDE RAILWAY
SINGLE TRACK TYPICAL SECTION



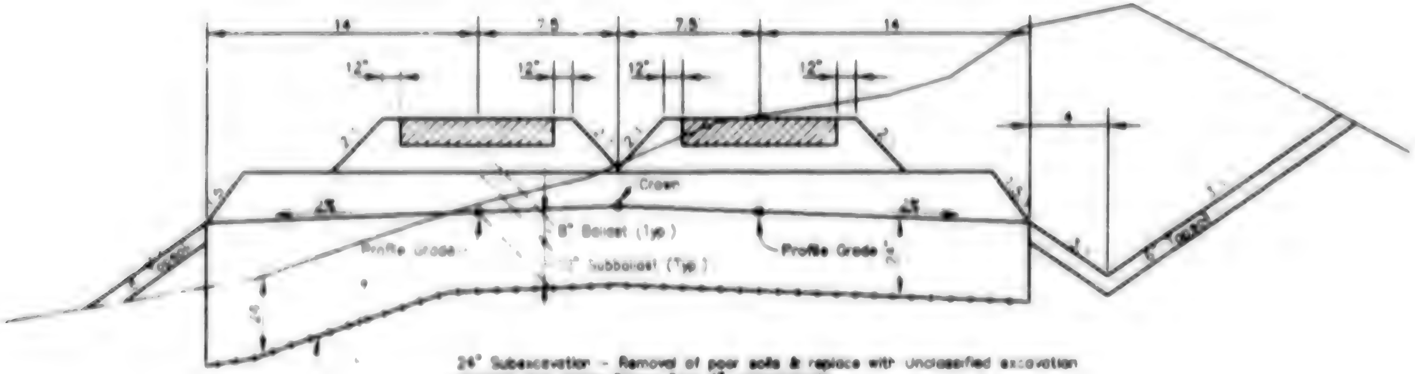
[illegible]

[illegible]

* per Alaska DOT specifications

* per Alaska DOT specifications

STAMPEDE RAILWAY
DOUBLE TRACK TYPICAL SECTION



24" Subexcavation – Removal of poor soils & replace with Unclassified excavation material that meets Borrow Type A* requirements

Geotextile Reinforcement

* per Alaska DOT specifications

Stampede Corridor Railroad Cost Estimate

ITEM #	PAY ITEM DESCRIPTION	PAY UNIT	UNIT COST	QUANTITY	EXTENSION
114(1)	CONSTRUCTION SURVEY BY THE CONTRACTOR	LUMP SUM	$3,500,000	1	$3,500,000
116(1)	FURNISHING AND MAINTAINING FIELD OFFICE	LUMP SUM	$25,000	1	$25,000
116(2)	FURNISHING AND MAINTAINING FIELD LABORATORY	LUMP SUM	$15,000	1	$15,000
116(3)	FURNISHING AND MAINTAINING CURING SHED	LUMP SUM	$5,000	1	$5,000
201(2B)	CLEARING AND GRUBBING	ACRE	$500	531	$265,500
203(3)	UNCLASSIFIED EXCAVATION	CUBIC YARD	$5	3,387,351	$16,936,755
204(1)	HAUL	C.Y.V.M.	$0.40	81,725,328	$32,690,131
	BALLAST	CUBIC YARD	$15	257,240	$3,858,600
	SUBBALLAST	CUBIC YARD	$6	498,020	$2,988,120
	TRACK & TIES	LINEAR FOOT	$75	459,080	$34,431,000
	TURNOUTS	EACH	$25,000	20	$500,000
630(2)	GEOTEXTILE, REINFORCEMENT	SQUARE YARD	$2.50	1,421,027	$3,552,568
603(1 – 36)	36 INCH CORRUGATED STEEL PIPE	LINEAR FOOT	$65	24,000	$1,560,000
603(3 – 36)	END SECTION FOR 36 INCH CORRUGATED STEEL PIPE	EACH	$300	684	$205,200
616(1)	3/4 INCH DIAMETER CULVERT THAW PIPE	LINEAR FOOT	$6	24,000	$144,000
618(2)	SEEDING	ACRE	$900	238	$214,200
620(2)	SALVAGED TOPSOIL	M.S.F.	$100	10,367	$1,036,700
640(1)	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	$6,000,000	1	$6,000,000
	BRIDGES	SQUARE FOOT	$200	77,250	$15,450,000
	MAJOR CULVERTS	EACH	$60,000	38	$2,280,000
	NET CONSTRUCTION COST	SUBTOTAL			$125,657,774
	SUPERVISION AND CONTINGENCY	PERCENT	31%		$38,953,910
	GROSS COST	SUBTOTAL			$164,611,683
	PLANNING	PERCENT	25%		$31,414,443
	TOTAL CONSTRUCTION COST	SUBTOTAL			$196,026,127
	EQUIPMENT AND FIXED FACILITIES	LUMP SUM	PRELIMINARY ESTIMATE		$15,000,000
	CONTINGENCY	PERCENT	16%		$2,400,000
	TOTAL EQUIPMENT AND FIXED FACILITIES COST	SUBTOTAL			$17,400,000
	TOTAL COST	TOTAL			$213,426,127

DESCRIPTION	COST
DEMOLITION & REMOVAL	$7,528,850
GRADING AND DRAINAGE	$54,691,086
STABILIZATION	$46,937,838
MAJOR STRUCTURES	$16,500,000
SUPERVISION AND CONTINGENCY	$38,953,910
PLANNING	$31,414,443
TOTAL CONSTRUCTION COST	$196,026,127
TOTAL EQUIPMENT AND FIXED FACILITIES	$17,400,000
TOTAL COST	$213,426,127

Notes:
- Equipment and Fixed Facilities Total Costs represent a net cost estimate plus 16% for contingencies. No supervision or planning cost percentages are applied.
- Construction Total Costs represent a net cost estimate plus 16% (of net) for contingencies, 15% (of net) for supervision and 25% (of net) for planning.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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END

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